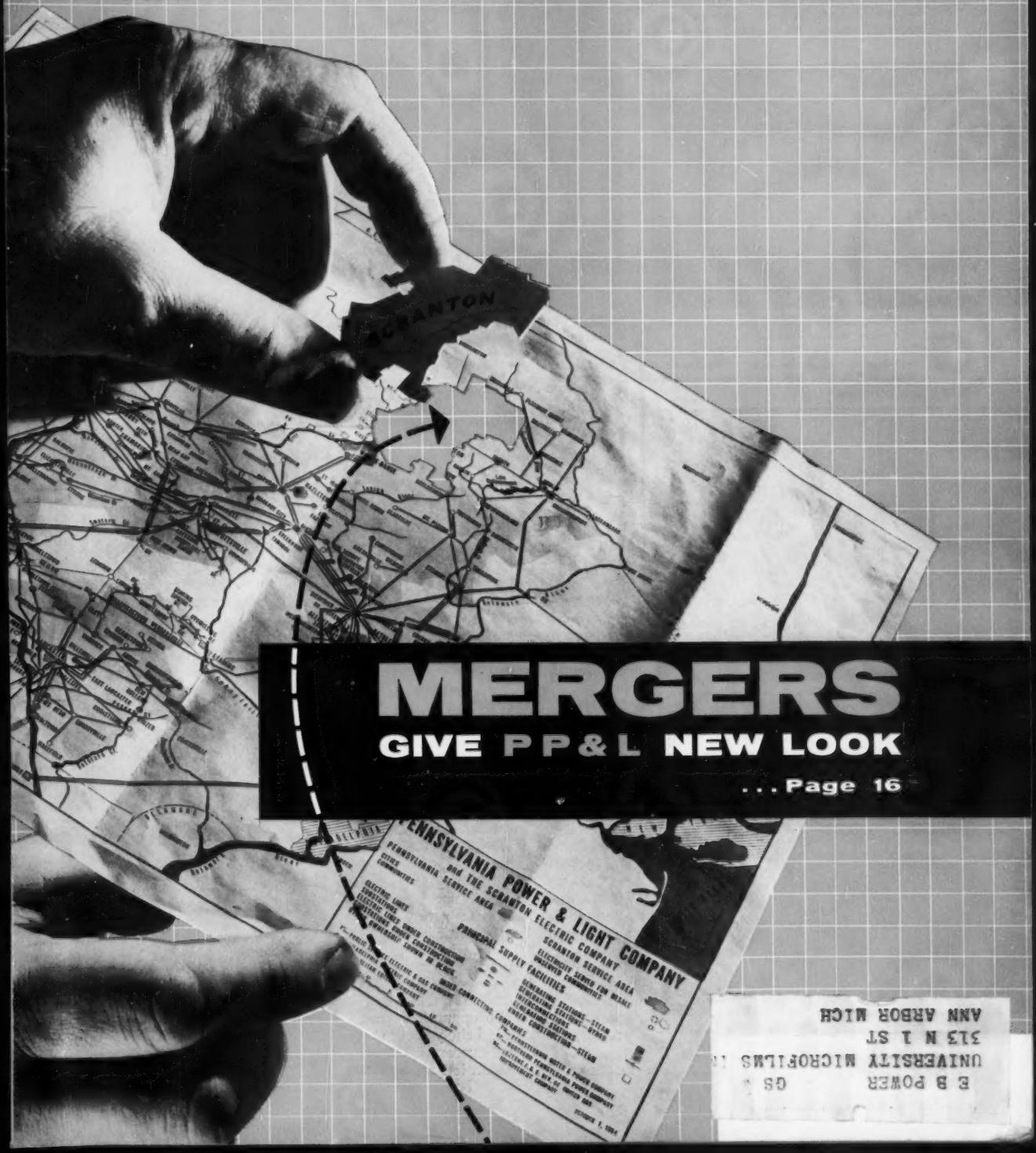
The Electrical Industry's Weekly Magazine

March 26, 1956

Electrical World

Price 35 Cents

A McGraw-Hill Publication



MERGERS GIVE P P&L NEW LOOK

...Page 16

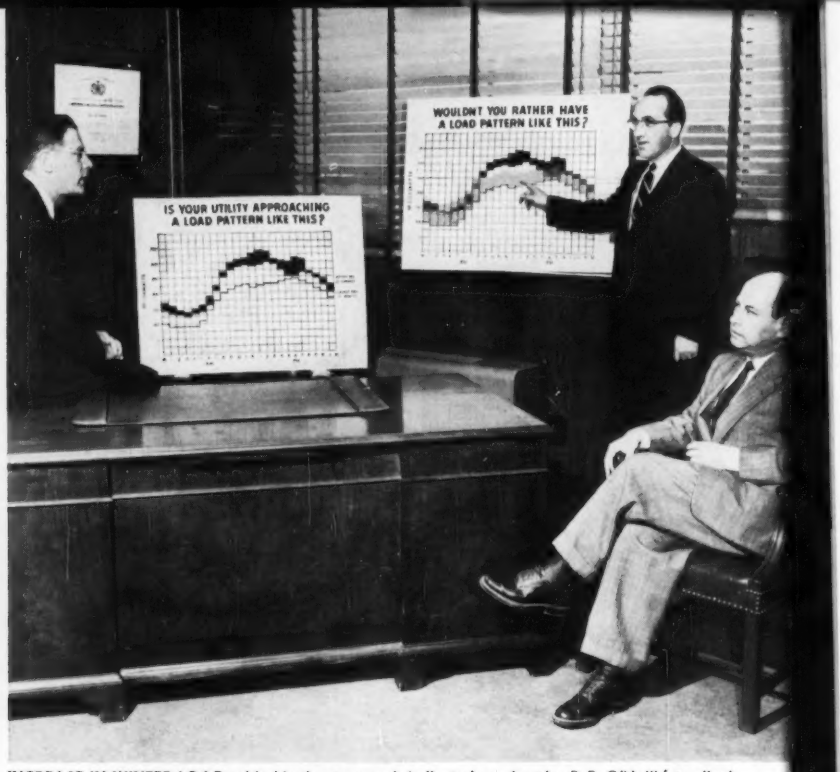
E B POWER GS
UNIVERSITY MICROFILMS
313 N 1 ST
ANN ARBOR MICH

G-E WEATHERTRON dramatically illustrates attractiveness for commercial market. New design offers wide variety of applications that cut floor space and completely eliminate fuel storage requirements.

CURRENT PRODUCTION CAPACITY at G.E.'s Bloomfield, N. J. plant is twice October 1955 figures as noted by G-E Executive Vice Pres. R. W. Johnson; H. M. Brundage, General Manager—Weathertron Department; R. P. Allison, Manager—Manufacturing.

COMPLETE SALES TOOLS help utilities promote the heat pump. For details, contact the General Electric Co., Weathertron Dept., Bloomfield, New Jersey.

MORE G-E SALES AID is provided by Weathertronics Institute, where utility men, dealers and distributors get a week's training at the factory in all phases of the fast-growing heat pump business.



INCREASE IN WINTER LOAD added by heat pumps is indicated on chart by P. F. O'Neill (standing), Manager—Utility Contacts. H. L. Williamson (left), Manager—Marketing, and G. K. Marshall, Manager—Product Planning, also of the Weathertron Department, note that not only is winter load raised but that the light load periods in the daily load curve are raised also by heat pumps.

As commercial applications develop . . .

Utilities prepare for expanding heat pump market

Now that year-round air conditioning's popularity perimeter has surged into Michigan and southern New England, the picture of a relatively unpromoted market for the heat pump, the commercial one, is coming into sharp focus. General Electric's market analysts predict that the heat pump portion of the commercial and industrial year-round air conditioning market will more than triple in the next ten years. This becomes even more significant considering the accelerated growth of air conditioning in general. Add to this the fact that, to date, 1 of every 2 heat pump installations have been for commercial or industrial use—even without concentrated sales action—and the potentials become even clearer.

Throughout the electric utility industry, these statistics have helped spark widespread preparations that promise to make '56 the year of the "big push" in all customer classifications. The reason is simple: the heat pump offers utilities an attractive opportunity to gain winter kwhrs and offset summer peaks. Separate utility budget items to promote and sell heat pumps and the inauguration of budget billing in market areas are only two of the signposts.

At General Electric, too, efforts are reaching fever pitch. G.E.'s new Weathertron production line is now in full-time operation, doubling the Company's capacity. New designs have made Weathertrons more saleable to commercial and industrial as well as residential prospects.

Continued coordination of activities between electric utilities and manufacturers, like General Electric, should make 1956 the first big year in the heat pump bonanza. General Electric Company, Schenectady 5, New York.

301-320

MORE POWER TO AMERICA

GENERAL ELECTRIC

Fischer Black, Publisher and Editor
Jesse Mock.....Asst to the Editor

Daniel T Braymer.....Managing Editor
Leonard M Olmsted.....Associate Editor
Kenneth K Kost.....Associate Editor
Herbert R Frankel.....Associate Editor
Rue M Shoop.....Associate Editor
George Swift.....Associate Editor
V Craig Richter.....Associate Editor
Edward Allen.....Midwestern Editor
H S Knowlton.....New England Editor
John J Kearney....Middle Eastern Editor
Francis Kovalcik.....Western Editor
Allen Long.....Northeastern Editor
David Rea.....Southeastern Editor
E Bryson Sessions.....Commercial Editor
Robert Rash.....News Editor
Arthur J Stegeman.....Assistant Editor
James G Plunkett.....Assistant Editor
Denise Hennessy.....Editorial Assistant
Theodore W Fuller.....Editorial Assistant
Ary Mossiman.....Mgr, Market Research
Frank C Stockman.....Art Director
H T Howland, Jr.....Production Editor
G B Bryant, Jr...Mgr, Washington Bureau
W Gilmour....Washington Correspondent
Dexter M Keezer.....Dir, Economics Dept
E Benoit-Smullyan.....Economist
A E Knowlton.....Consulting Editor

Domestic News Service: Atlanta, Chicago, Cleveland, Detroit, Houston, San Francisco.

World News Bureau: John Wilhelm, Editor Bombay, Bonn, London, Mexico City, Paris, Rio de Janiero, Tokyo.

Warren W Shew.....Sales Manager

District Managers: N V Palmer and E S Chapin, New York; E S Chapin, Boston; F P Coyle, Philadelphia; M S Kearney, Cleveland; M I O'Connell, Detroit; W H Meneilley and J T Schaefer, Chicago; J T Schaefer, St. Louis; C W Dysinger, Los Angeles; R C Alcorn and T H Carmody, San Francisco; William Lanier, Atlanta; James Cash, Dallas.

Otto Drechsel.....Business Manager

ELECTRICAL WORLD

Published weekly by McGraw-Hill Publishing Co., Inc., Executive, Editorial and Advertising Offices: **McGraw-Hill Building, 330 West 42nd Street, New York 36, N. Y.** Publication Office, 99-129 North Broadway, Albany 1, N. Y.

Donald C. McGraw, President; Paul Montgomery, Executive Vice-President; Joseph A. Gerardi, Executive Vice President and Treasurer; John J. Cooke, Secretary; Nelson Bond, Executive Vice President, Publications Division; Ralph B. Smith, Vice President and Editorial Director; Joseph H. Allen, Vice President and Director of Advertising Sales; J. E. Blackburn, Jr., Vice President and Circulation Director.

Subscriptions: Address correspondence to Electrical World—Subscription Service, 99-129 North Broadway, Albany 1, N. Y. or 330 W. 42nd St., New York 36, N. Y. Allow one month for change of address.

Subscriptions are solicited only from executive, supervisory, and engineering personnel in electric utilities, manufacturing companies, and related fields. Position and company connection must be indicated on subscription orders.

Single copies 35¢. For the United States and possessions and Canada, $6 a year, $9 for two years, $12 for three years. Other Western Hemisphere, and the Philippines, $15 for one year, $25 for two years, $30 for three years. All other countries, $25 for one year, $40 for two years, $50 for three years. Entered as second class matter at the Post Office at Albany, N. Y. Printed in U.S.A. Copyright 1956 by McGraw-Hill Publishing Company, Inc. Permission required to reproduce any of contents.

Electrical World

Published for 82 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

VOL 145 No 13 March 26, 1956

MANAGEMENT

MERGERS GIVE PP&L NEW LOOK 16
COMMONWEALTH EDISON STARTS ELECTRONIC BILLING
P. W. Boyer 24

Industrial Relations 51
Business Outlook 60
Finance and Regulation 63
Statistics 66

DISTRIBUTION

USE HIGHER CSP BREAKER SETTING ..... J. P. Barron 22

GENERATION

SODIUM GRAPHITE PILE SHOWS PROMISE ..... Chauncey Starr 44

MEETINGS

PEA ELECTRICAL EQUIPMENT COMMITTEE 18
MVEA INDUSTRIAL AND COMMERCIAL SALES CONFERENCE 32

SALES AND SERVICE 55

EDITORIAL AND COMMENTARY

Editorials 5
In the Industry 62
Technical Notes 62

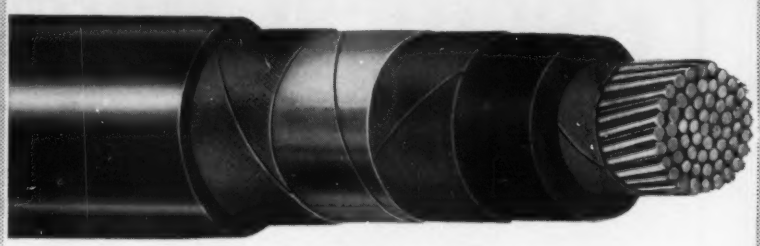
INDUSTRY NEWS

Electrical Week 6
Current Events 8, 15, 30
News About People 36
Meetings Calendar 43
Manufacturers and Markets ... 56

• • •

COMING NEXT WEEK—The industry is well aware of the effect of heat storms on overhead distribution. But what happens when a heat storm goes underground? EW will provide the answer in a 16-page special report.

ADVERTISEMENT



RoZone insulated, RoSeal sheathed, shielded power cable for high-voltage application through 15 kv.

Why a Thermoplastic Sheath on Rubber Insulated Shielded Power Cable?

When you buy shielded power cable you don't generally inquire, "why have a sheath at all?" But it would be a fair question, answered something like this:

You (and we) expect a nonmetallic sheath on shielded power cable to:

1. Protect the insulation and shield during installation.
2. Be equally satisfactory for use in ducts, buried directly in earth and aerially.
3. Resist weather and soil conditions.
4. Have adequate moisture resistance.
5. Be easy to pull, handle, install.
6. Resist burning.
7. Be flexible enough for installation at sub-zero temperatures.
8. Be durable and homogenous.

Originally, braids and lead

Early efforts to meet these requirements involved fabric braids or lead sheaths. Braided coverings were relatively inexpensive; but they rapidly oxidized and rotted. Lead was (and is) a fine protector; but it was costly, hard to handle, it corroded, and was easily damaged.

Next, Neoprene

In 1932, a few cable makers began using Neoprene instead of the conventional older materials. As a sheathing material, Neoprene offered definite advantages over lead and braids. Obviously, Neoprene solved the rotting problem with braid. And, used in place of lead, Neoprene has cut cable cost, made handling easier, and resisted damage better. It provided oil, flame and sunlight resistance when used over rubber.

Next problem, shielding

But at certain voltage levels the electrostatic shielding formerly provided by lead sheathing was still needed. The IPCEA shielding recommendations were established and the logical solution to achieve the shielding effect was a metallic tape wrap between the insulation and the nonmetallic sheath.

The solution

After years of research, we developed a material of which we're very proud. Its name is RoSeal and it is a thermoplastic. Applied over premium quality RoZone insulation, RoSeal is a completely satisfactory sheath for shielded cable rated up to 15 kv.

Here's what you'll get from RoSeal

1. A rugged protective covering with toughness and other good mechanical properties.
2. Resistance to attacks from any micro-organisms.
3. Resistance to weathering and soil conditions (equal to Neoprene).
4. Exceptional moisture resistance (superior to Neoprene).
5. Much easier pulling (RoSeal's friction coefficient is lower than that of any other sheathing material because of its waxy structure). Pulling lubricants not generally required.
6. Flame resistance.
7. Easy bending (superior to Neoprene) and installation at sub-zero temperatures.
8. Durability and long life (equal to Neoprene).

And lower cost, too

This new development, RoSeal, offers you an additional benefit due to the inherent economy of RoSeal sheath as compared with Neoprene.

Other advantages

In every test, you'll find that RoZone insulated, RoSeal sheathed cable has uniformly high corona levels and electrical properties.

You'll find that RoSeal has greater resistance than Neoprene to oils and most chemicals and immeasurably better moisture resistance.

This advantage is of considerable importance in industrial applications and for direct burial in earth.

What RoSeal looks like?

Installation procedures for new RoZone-RoSeal are the same as for Neoprene sheathed cable. Its general appearance is the same, as are dimensions, ratings, and everything else.

You can use RoZone-RoSeal aerially, in ducts, and installed directly in earth.

Send for data

Detailed specs and engineering data are yours for the asking.

ROME CABLE CORPORATION, Rome, N. Y.

EDITORIALS

The Strike Ends

On all sides there is a sense of relief that the five-month strike at the Westinghouse Electric Corp is over. Utilities shortly will be notified of the revised shipping schedules which will enable them to firm their construction plans. Westinghouse management can now plan more firmly with more confidence of labor stability.

Patience on the part of customers is still required as the company reassembles its working force and readies its facilities for full production. This could take weeks.

For the utilities the settlement finally reached promises a much larger measure of productive and cost stability than existed before the strike. This is vitally needed as the industry continues its expansion to meet constantly growing loads.

Throughout these critical months the utilities have remained confident that the strike would be brought to a reasonable settlement. Much of the industry was aware that Westinghouse management was battling on several issues of industry-wide significance. The support given by utilities was undoubtedly a factor in Westinghouse's successful fight during these months.

The entire industry deserves praise for its spirit of cooperation during the strike.

Let's Define Capability—II

Recently on this page (Feb. 13) it was suggested that the industry should settle on a standard definition of capability that can be uniformly applied to all machines. This plea was made in the interest of eliminating confusion and to facilitate comparison of power plant unit costs and performances.

At that time we offered for consideration a definition that has been called "Manufacturer's Maximum Guaranteed Turbine Capability." This term has some following today. But there are others who differ. This group points out that as it is a "manufacturer's maximum" guarantee, it is not a maximum at all, but in reality the minimum output that the manufacturer will stand behind.

We now offer a second definition of capability proposed by this group and already given the blessing of three industry committees.

For lack of a better name it might be called Rated Turbine Capability. It specifies that: "The turbine rating of a steam-electric turbine generator set shall be the guaranteed continuous output in kilowatts at generator terminals when the turbine is clean and operating under specified throttle steam pressure and temperature, specified reheat temperature, specified exhaust pressure, and with full extraction from all extraction openings."

It is not our purpose here to anticipate the action that industry committees should take in standardizing this key definition. However, it is certainly encouraging to note that definitive action is being taken to correct the worrisome situation that has been allowed to exist for so long.

Let us hope that progress thus far made will not bog down in bootless argument but will go speedily forward to a single standard definition for capability acceptable to all.

'Naow, Cousin, Thet's Livin'!'

Houston Lighting & Power Co has been among the most active in the nation in promoting adequate wiring. Its program for certifying adequately wired homes has been well publicized and has made quite a hit with builders, real estate brokers, and homeowners in its service area.

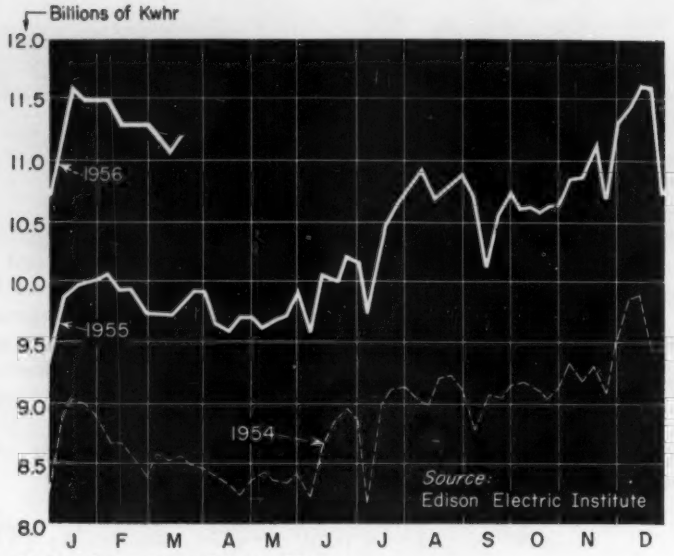
But its current advertising goes even beyond that. It dramatizes adequate wiring as an easier way of living. By use of cartoons and copy, the company is making adequate wiring a wanted item for all homes. Here is a company that has already explained "adequate wiring" and is now selling it.

Sample copy in a recent ad:

"Possum and sweet pertaters a-bakin in the 'lectric range, washin' machine a-washin', TV a-hollerin' . . . naow, cousin, thet's livin.'"

ELECTRICAL WEEK

LAST MINUTE



OUTPUT

Week ended Mar. 17
11,202,000,000 Kwhr
Up 14.1%

Atomic Energy Commission requirements — 1,125,000,000 kwhr (Electrical World estimate). Excluding AEC output increase was 10.4%

Per Cent Change From Previous Year

	Total US	New Eng.	Mid. Atlan.	Cent. Ind.	West Cent.	South-east	South Cent.	Rocky Mount.	Pacific NW	Pacific SW
Mar. 17	+14.1	+11.9	+10.8	+20.1	+11.5	+13.8	+10.0	+12.0	+16.4	+9.6
Mar. 10	+14.5	+11.9	+8.6	+23.1	+9.1	+11.9	+12.1	+10.8	+18.2	+14.2
Mar. 3	+15.1	+10.2	+8.9	+22.7	+7.6	+17.5	+10.7	+10.1	+17.2	+11.8

Seasonally Adjusted Index 214.9 Week Ago 213.2 Year Ago 188.1

Issue's Highlights—Westinghouse strike ends as IUE accepts contract terms . . . Pacific G&E's 156,250-kw generator in Pittsburg Plant fails, causing explosion and fire injuring nine men . . . House approves use of TVA power revenues to finance new generating capacity.

New Heat Pump Contender—Frigidaire Division of GM is planning to make full-scale entry into heat pump market in June and hopes to sell 300 to 400 units this year. Pumps will be air-to-air "split unit" type (refrigerant circuit in two units, one outside and other in house, tied together by refrigerant lines).

Tract of 185 all-electric, heat pump-equipped homes (priced at $19,500) is planned in St. Louis, Mo., area. Another heat pump project of 40 homes is scheduled for Huntsville, Ala.

Labor—Wisconsin Electric Power and IBEW agree to 5% wage hike plus half holiday and increased term life insurance . . . Westinghouse employees at Sunnyvale, Calif., plant, have elected IBEW as bargaining agent over incumbent UE-Ind . . . Arizona PS has upped wages of 1,026 non-union employees 3½%. Similar increase has been offered IBEW members.

Co-ops Gain in Mississippi—State's co-ops have gained right to compete for business in municipalities. Action comes about following tabling of an amendment which would have given private companies right to serve municipality when it expands its borders into co-op territory.

Rate Matters—Pennsylvania PUC has denied proposed rate revision by Metropolitan Edison and has ordered reduction of $943,828 a year in existing rates. ME had proposed raising some residential rates and lowering industrial and commercial charges for a net decrease of $71,000 . . . Virginia SCC has granted $67,000 a year rate increase to Powell Valley Electric Co-op.

NEWS OF THE INDUSTRY BRIEFLY TOLD

Washington Wire—FPC annual report last week stated U. S. utilities would need installed capacity of 360 million kw by 1980 to meet anticipated peak demand for 310 million kw plus 15% reserve. Report said new capacity scheduled at end of 1954 for installation through 1958 totaled 22.5 million kw.

High on list of potential candidates for post of Secretary of Interior are three Westerners: Former Governor of Colorado Dan Thornton, former Governor of Arizona Howard Pyle, and Gov Milward L. Simpson of Wyoming. All three are Republicans who have been associated with the policies of the Eisenhower administration.

AEC's insurance study group has issued progress report indicating liability coverage from private carriers will reach $65 million for each atomic facility. Group warned, however, this amount will have to cover all parties involved—contractors, suppliers of components, and others allied with an operator . . . FPC hearings have begun on application by Electric Energy, Inc, to up power rates to AEC from 4.85 mills to 5 mills, or $70,000 a year.

Construction Bids for Pelton—Guy F. Atkinson Co is apparent low bidder at $6.5 million for construction of Portland GE's Pelton hydro project on Deschutes River. Construction will start 15 days after award of contract.

New Generator Operating—Cleveland Electric Illuminating has placed in operation a 240,000-kw turbogenerator of revolutionary design at its Eastlake plant. New unit is first large generator in history of industry to utilize liquid-cooled conductors.

Chile Copper Expansion Planned—Chilean government has authorized Anaconda and Kennecott Copper to undertake $55.9 million expansion of production facilities.

Goodwill Gesture—GE will devote time on its TV Theater program April 1 to pay a tribute to one of its sub-contractors—Abilities, Inc. This organization consists entirely of disabled personnel.

ABOUT PEOPLE IN THE INDUSTRY

Cost of federal power development was underscored by Interior Secretary Douglas McKay when he told Young Republican Club of Columbia University it will take $300 million a year to develop nation's hydro resources. "If anybody thinks he is going to get that kind of money out of Congress, he is just plain nuts." Secretary also disputed argument that TVA is self-supporting. It is "subsidized power," he said.

Unsolved problem of atomic liability insurance now stands in the way of full development of peaceful uses of atomic energy, Rep W. Sterling Cole (R-N. Y.) said last week. "In order to have private enterprise participate fully in this development, the only solution seems to be for the government to limit the liability of a reactor operator, then have the government take over the balance of the liability," he suggested.

More News About People page 36

WESTINGHOUSE' PRICE

Westinghouse, IUE end 156-day-old walkout as union accepts contract terms. Company gets 5-year period sought as . . .

IUE's CAREY

Westinghouse, Union Settle Strike

Last week Gwilym Price, president of Westinghouse Electric Corp, acknowledged the news that his company's 156-day-old strike had ended, with the following statement to EW:

"The loyalty and understanding of our electric utility customers during this prolonged strike has been extremely gratifying to all of us at Westinghouse.

"Now that agreement has been reached with the IUE, we will do everything possible to achieve maximum production quickly. Although the strike has been of long duration, I am firmly convinced that Westinghouse has the loyal support of its employees that they will maintain the high quality and performance of our products which have been the foundation of the company. This means we can now look forward to normal business relations."

This statement from Price was issued the morning after the strike had been settled giving the company the five-year contract period it had sought from the beginning.

In essence, it was a fact-finding maneuver that brought about the agreement. With federal mediator, John R. Murray, two special arbitrators—David L. Cole, former federal mediation director, and George W. Taylor, former Wage Stabilization Board chairman—took the results of the long negotiating sessions and formed a compromise plan (for company's original offer, see EW, Nov. 14, 1955, p 110). These are the details of the settlement:

• Length of Contract—A four-year pact was accepted to run until 1960, in reality five years from the time that the strike began (Oct. 17), with local unions reserving the right to negotiate local supplements each year separately in addition to those provided by the master agreement. However, the local option is not expected to affect the stability of the long-term agreement. The contract can be opened in 1958 for guaranteed annual wage discussions and for non-wage issues in 1957. The five-year agreement was a company demand.

• Wages—The wage increase averages slightly above 23½¢ for the five-year period. Improvement in pensions and personal insurance plans for employees and cost-of-living wage adjustments were included.

• Time Studies—The company will be permitted to make time studies for production workers not on incentive pay. But any new work standards adopted as a result of the time studies will be arbitrated if the union objects to the standards. Westinghouse had refused during negotiations to agree to third-party arbitration of the work standards.

• Discharges—Thirty-six employees fired during the course of the strike become indefinitely suspended. Their cases will be screened between the company and union officials at the plant level and if no agreement can be reached on rehiring or final discharge, the case then goes to arbitration.

This was the only substantive change in the panel's recommendations, which proposed that the 36 cases be arbitrated without first screening them. The panel had already proposed that 57 others discharged during the strike be rehired and this went through.

The final settlement package was reached in a 23-hour session between three-man negotiating teams, led by the IUE Pres James Carey for the union and Vice Pres Robert Blasier for the company. The discussion led by the panel centered around the terms written by the government team —Private Labor Relations Experts Cole and Taylor, and Federal Mediator Murray—and it became the basis for settlement only after the panel had convinced both sides that this was the only way out. And the panel, virtually, had to write the contract.

Discharge Issue Delayed End

Even then, the union's full negotiating team needed another 20-hour session to take the contract. The lingering issue of union members discharged by the company for alleged violence split the 14-man union negotiating committee down the middle, with Carey favoring the compromise that provided screening of the discharges, relabeled suspensions in the final agreement, at the local plants where they occurred. Arbitration would be the final end of the firings

Generator Failure Studied

. . . at Pacific G&E's Pittsburg Plant where 156,250-kw unit broke down in speed tests with resulting fire, explosion

A mechanical failure within the generator of the 156,250-kw Unit No. 1 at Pittsburg Station of Pacific Gas & Electric Co occurred at 7:57 PM Sunday, March 18. The failure took place while the machine was undergoing normal overspeed tests following routine overhaul. It was accompanied by an explosion and fire apparently caused by escaping hydrogen. Nine men were injured. Investigations into the nature and cause of the failure are under way by the utility and by General Electric Co, makers of the machine.

According to officials of PG&E, the generator shaft of No. 1 unit twisted and broke at the point where the shaft enters the generator from the turbine end. The generator housing fractured, and the exciter housing buckled. Fire, which broke out at both ends of the generator was put out with hand extinguishers.

Unit No. 1, which is one of four similar 156,250-kw turbo-generator units installed in this outdoor-type station (EW, April 19, 1954, p 116), had been shut down for routine overhaul since January. It had carried load briefly a few days before the accident but was not on the line when the failure occurred.

PG&E officials said that it was not likely that the failure was caused by the overhaul or the tests on the unit.

The adjacent No. 2 unit relayed off the line when the blast occurred. It was examined, but extent of damage has not been estimated. It was expected to be back in service by the weekend of March 24-25. The remaining two units at Pittsburg continued in operation following the accident.

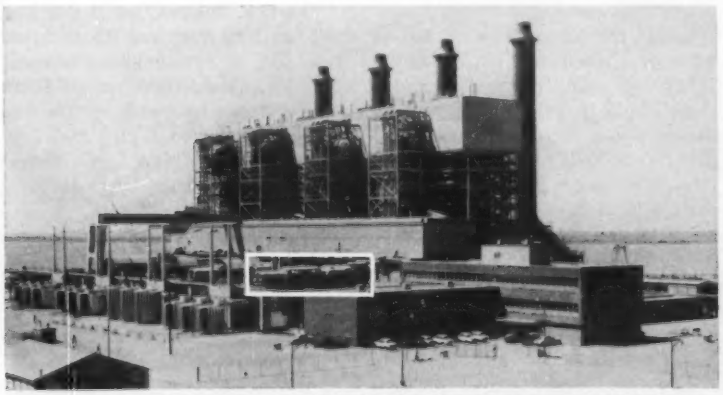
Dismantling of the damaged machine was begun on March 20, it was reported. Company officials estimate that it will be several months before Pittsburg Station will be back in full operation.

The PG&E's total system generating capacity is 4,300,000 kw plus about 500,000 kw purchased from others. Loss of the capacity resulting from the accident was replaced from reserves which are said to be about equal to the capacity of the four Pittsburg machines. PG&E customers were not asked to cut demands.

Spokesmen from General Electric Co issued the following statement:

"A General Electric steam turbine generator, one of four in an outdoor installation at the Pittsburg Station of Pacific Gas & Electric Co failed Sunday about 8 PM Pacific time.

"Based on information received, GE officials here (Schenectady) said that it is believed failure occurred in the generator portion of the 183,824 kva, (0.85 pf) unit. Operating since 1954 (May) this unit was undergoing normal overspeed test following a six week routine overhaul when the failure occurred. The other three turbine generator units at the station, also manufactured by GE, were not affected by the failure.



PG&E's PLANT WITH FAILED UNIT INDICATED BY WHITE SQUARE

"W. E. Saupe, general manager of the large steam turbine-generator department, yesterday (3/19) dispatched a five-man investigating team to the Pittsburg power station to assist in determining the cause and extent of the failure. Saupe pointed out that the turbine generator unit is similar to a large number of steam turbine generator units produced by General Electric which have been operating efficiently at the guaranteed ratings ever since they were installed.

"While a complete investigation of this failure will be given top priority," Saupe said, "no major modification to the many similar units in operation throughout the country is contemplated."

Pittsburg station is located west of Pittsburg, Cal., on the southern shore of Suisun Bay which connects by Carquniez Strait through San Pablo Bay to San Francisco Bay. Its four generators are rated 183,824 kva at 0.85 pf. 18,000 volts, 3,600 rpm. The unit that failed was shipped during the 30th week in 1953 and was placed in service in May 1954. The station, which is of the outdoor type has the ends of the turbines, control room, and firing aisles enclosed. The turbine generators rest on pedestals which project from the firing aisles.

Westinghouse Strike

(*Continued from previous page*)

that could not be resolved. At least six members of the negotiating committee held out until the last minute for full reinstatement, but the struggle had run its course. Required approval by the union's 75-man conference board was routine.

In a six-page statement released shortly after the strike was settled, the union said:

"Westinghouse officials must recognize most of all that their strategy of trying to starve us into submission has failed and we emerge from this strike strong, united, and determined.

"Now we have an agreement that we can accept. It is our responsibility as leaders to accept it and utilize our strength to see that its terms are carried out honorably and fairly."

Blaiser, speaking as head of Westinghouse' industrial relations, commented, "All in all, we are highly pleased with the entire settlement."

TVA Self-Financing Gains

House Appropriations Committee votes to permit agency to use its power income for constructing new generating capacity

The move to put the Tennessee Valley Authority on a self-supporting basis and grant it broad powers to expand has gained ground. The House last week voted to permit TVA to use its power income for construction of new generating capacity. This followed approval by the Appropriations Committee which had upheld one of its subcommittees.

With President Eisenhower's endorsement, TVA had asked Congress for a $3.5-million appropriation to pay for initial orders on a fourth 180,000-kw unit at John Sevier Steam Plant. While awaiting the decision, it ordered the equipment, pledging power revenues as payment should the request for new money be denied.

Denial Aids Power Income Plan

New money was denied. But TVA's short-cut was upheld (EW, March 19, p 113). And this was what the agency really wanted.

Under ordinary circumstances, TVA would have been glad to get new unfettered money to pay for its unit. But the agency is engaged in a campaign for legislation to permit it to issue revenue bonds to finance future expansion. It wanted to test the tenor of Congress on this move. Not only did the vote reassure TVA of Congress' attitude in this respect, it marked the first step toward installation of the Sevier unit.

Dissenters Warn of Exploitation

The committee vote, however, was not unanimous. Five members dissented vigorously, taking the opportunity to warn that TVA is exploiting all possible methods of obtaining new generating capacity and that this capacity is being used to entice industry away from other areas, rather than to supply existing customers.

The majority report made two significant points:

- Payment of initial costs of the Sevier unit from power revenues, rather than appropriations, is the cheapest way out for the government.
- The new unit can be added at comparatively low unit cost. Three existing units are making use of common equipment—rail connections, coal yards, stacks. No duplication is required for another unit.

The minority—Reps John Taber (R-N.Y.), Glenn R. Davis (R-Wis.), Ben F. Jensen (R-Iowa), John Phillips (R-Calif.), and T. Millet Hand (R-N.J.)—had this to say:

- TVA's interpretation of the law, which the agency construes as giving it authority to apply power revenues to expand generating capacity at existing plants, was faulty. The minority holds that the law forbids this.
- No more money should be given TVA to expand its steam generating capacity until Congress resolves the basic question of whether TVA has authority to build steam plants in the first place.

Call Bonds U. S. Obligation

- TVA revenue bonds, "whatever icing may be spread over this proposal," would be obligations of the government. "Any idea that we should permit the TVA, an agency of our U. S. government, to issue revenue bonds which would become contingent obligations of the U. S. is unthinkable."
- "The proper choice," they said, is the path being taken by the City of Memphis, Tenn., which has decided to build its own steam plant. The five members termed Memphis "the first of the captive municipalities to take itself out from under TVA bondage."

Utility Relocation Bill Seen for House

A long-range $38.8-million highway construction bill providing partial reimbursement for necessary relocation of utility lines and equipment is expected to go before the House early next month.

It is a controversial bill, with rough sledding ahead. But it's not too far removed from the program laid down earlier by President Eisenhower, and it stands a chance of favorable action before the present session of Congress ends.

The utilities relocation provision may not do in the final bill. It is one of a flock of provisions which have kept a House public works subcommittee busy for several months, and it represents a last-ditch attempt at a compromise in order to get a bill before the full committee and the House—each of which will have a chance to tear it apart.

The measure provides, simply, that federal payments be made to offset up to 50% of the costs of relocations made necessary by federal highway construction, provided they do not exceed 2% of the total cost of a road-building project.

That's the provision contained in the original version of the Fallon bill (HR-8836) and it matches one in the Gore bill (S-1048) already passed by the Senate. It had been knocked out of the Fallon bill, and a provision was substituted which provided for reimbursement to state governments when the states had paid for utilities relocations.

The present relocation provision stands as much chance of getting House approval as do several others. But it must be realized that tax provisions may bog the whole measure down this session.

Highway Lighting Tests Mercury, Fluorescent

Connecticut's State Highway Department is running tests to determine whether part of its new 129.3-mile Greenwich-Killingly highway will be lighted by fluorescent or mercury fixtures.

The G-K Highway, as it is called, will link New York and Rhode Island at a cost of $400 million. Intersections and interchanges on a 53-mile stretch from Greenwich to Branford will be illuminated.

A test strip in Old Lyme, Conn., has been constructed by Connecticut Light & Power Co. The strip is being used experimentally for half a mile each of mercury and fluorescent illumination.

Connecticut's State Highway Commissioner Newman E. Argraves will decide in the near future upon the type of lighting to be used on the highway.

Did YOU ever close a cutout against a fault?

When a distribution cutout blows, the blast of flame and "shrapnel" is a hazard to anyone near the line of fire. It is even more dangerous when an operator closes in on a heavy fault with a cutout that is inadequate—that fails and perhaps explodes.

No longer are these necessary hazards for the men who work on electric utility lines. They are not "calculated risks" to which linemen need be subjected.

Because today distribution lines (4.8 Kv and below) can be protected with the S&C Positect—a cutout so safe that most linemen close it by hand. The Positect is safe from explosion because:

1. *INTERRUPTING CAPACITY* is high enough to meet every fault condition on a typical feeder—yet available at "normal duty" prices.
2. *DESIGNED AND TESTED* for closing against a fault—"make" as well as "break."
3. *INTERRUPTING RATINGS* apply to closing in on a fault—not just clearing it.

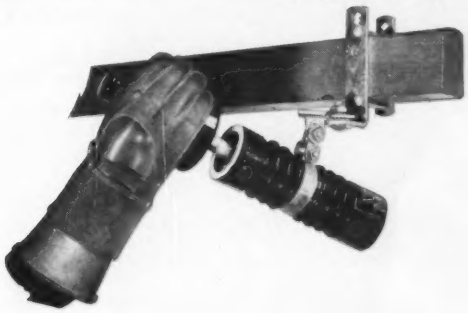
The Positect is safe when it blows because:

4. *BLAST DIRECTED AWAY* from the operator, so he is out of reach of the arc, flame, and "shrapnel" in case he closes in on a fault.
5. *KICKBACK PREVENTED* by high inertia of the fuse tube as it is driven home, directly opposing the recoil forces.
6. *BLAST MINIMIZED* by arc shortening and freer venting.

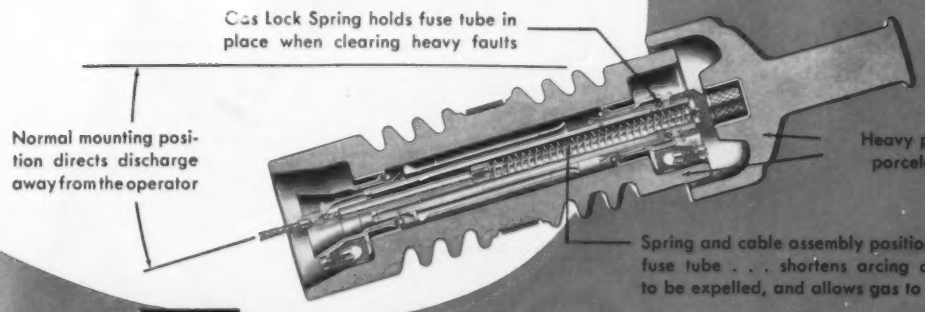
Other safety elements include (1) minimum exposure to live parts; (2) no dangling fuse link pigtail; and (3) ability of the Positect to perform load switching duties.

Detailed information on S&C Positects is contained in Catalog Section 520, available on request.

The Positect (below) is so SAFE that no hook stick is needed . . . it is ordinarily closed by hand



Sectional diagram of the S&C Positect shows how Safety is built in


Gas Lock Spring holds fuse tube in place when clearing heavy faults
Normal mounting position directs discharge away from the operator
Heavy porcelain handle and heavy porcelain housing oppose recoil
Spring and cable assembly positions fuse link in lower end of fuse tube . . . shortens arcing distance, eliminates pigtail to be expelled, and allows gas to be discharged more freely

Specialists in High-Voltage Circuit Interruption since 1910

S&C ELECTRIC COMPANY

4421 RAVENSWOOD AVENUE • CHICAGO 40, ILLINOIS, U. S. A.

In Canada: S&C Electric Canada, Ltd., 8 Vansco Road, Toronto 14, Ontario

POWER FUSES • DISTRIBUTION CUTOUTS AND FUSE LINKS • LOAD INTERRUPTERS • METALCLAD SWITCHGEAR

DISTRIBUTION TRANSFORMERS

THIS BOLT

COULD SAVE YOU...$3,000

Estimate your possible savings in terms of all transformers on your lines

When the neutral terminal on a 25-kva transformer broke, it put 240 volts across the 120-volt lines of several customers of a Northwestern utility. Result? Nine irate customers sued the utility for about $3000 worth of ruined household appliances.

This was an unusual situation, of course. But ordinary terminals sometimes crack, and the results can be serious. The usual villain is stress-corrosion, initiated when a lineman tightens the terminal clamp close to the metal's yield point. Corrosive elements go to work and eventually the terminal clamp breaks, dropping the line and bringing customer complaints.

G-E Strenicor terminal clamps can save you that expense. Designed to be 100% resistant to stress-corrosion, the clamps are practically immune to failure. Forged from a new copper-nickel-silicon alloy—Strenicor—G-E clamps have a tensile strength of 107,000 psi, and will resist corrosive atmospheres that cause failure in ordinary copper alloys.

Look at the other money-saving features that prove "all transformers are not alike": **Impulse testing,** for instance, saves years of transformer life. **One-piece clamping bands** save maintenance time. Reusable Nitrile rubber gaskets help save units from contamination. **AL/CU terminals** are designed to prevent both copper and aluminum conductors from loosening. **Super Melaglyp paint** saves up to two repaintings. **Nationwide warehouses** save utilities heavy inventory expense. **Service shops** can cut your repair and rebuilding costs.

For the complete story, contact your nearest G-E Apparatus Sales Office or G-E Agent—or write to General Electric Company, Section 431-37, Schenectady 5, N. Y.

dollar-saving features prove ATANA*

***ALL TRANSFORMERS ARE NOT ALIKE**
(make this simple comparison and see)

FEATURE	General Electric	Mfr. A	Mfr. B	Mfr. C	Mfr. D	Mfr. E
Production-line impulse testing	√			√		√
Nitrile rubber gaskets	√					√
One-piece clamping band	√					
H-v and l-v terminals handle both copper and aluminum conductors	√					
Strenicor pressure terminal clamps	√					
Super Melaglyp paint	√					
More than 100 warehouses	√	√				
Nationwide, company-operated service shops	√	√				

Progress Is Our Most Important Product

GENERAL ELECTRIC

re-shaped fields cut insulation expense on 345-kv line

O-B Control Rings redistribute electrical stress; permit use of standard hardware on extra-high voltage transmission line.

O-B knowledge of shield devices and their effect on the distribution of electrostatic stress forestalled expensive, time-consuming hardware development for this 345-kv transmission project. Thanks to a rich background in corona research, our engineers already knew *how* to design and evaluate shield rings when Ohio Brass Company was given the job of supplying materials for this line. Because of the redistribution of electrostatic stress with the proper ring design, it was possible for the builder to use conventional O-B suspension hardware and insulator designs.

Among the suppliers of materials for extra-high voltage transmission lines, *only Ohio Brass Company manufactures both insulators and hardware;* Ohio Brass Company maintains a high-voltage laboratory in which the design of both classes of product can be studied, separately and in combination. Research guiding, and then applied to, the design of these materials assures every O-B user of the best in every combination of insulating materials!

OHIO BRASS COMPANY • MANSFIELD, OHIO

Ohio Brass

4666-H

Coal Contract Spells Savings

. . . for Tampa Electric which signed 20-year pact last year for 750,000 tons annually; coal price since has risen $1.60 a ton but remains unchanged for utility; big cost advantages over oil

A long-term coal contract has already resulted in considerable savings for Tampa (Fla.) Electric Co although no coal has been shipped yet. If prices continue to rise the benefits will be even greater for the first major Florida utility to use Kentucky coal for power production.

Since the contract was signed the price of coal has increased $1.60 a ton. But because of the contract, Tampa Electric's cost has not changed, said W. C. MacInnes, president of the utility.

Although the per-ton price was not made public by MacInnes, he commented that it was very favorable. Escallation is provided over the contracting period, but according to that clause the price cannot exceed 20% of the initial price. There is also a downward escallation in case coal prices drop.

Tampa Electric signed the 20-year contract last year with Nashville Coal Co for 750,000 tons of coal a year to provide fuel for two 120-Mw units at Gannon Station, now under construction. Coal deliveries should start March 1957 with price near the '55 level, MacInnes commented.

Contributing to the favorability of the contract is a credit the utility receives for phosphate barged from Tampa on the return trip. On the coal delivery trip, the coal from a West Kentucky field will be barged down the Mississippi River and across the Gulf of Mexico to the utility's dock beside the new station.

It is estimated that energy generated at Gannon Station using Kentucky coal will be 30% cheaper initially than by burning oil—the only other fuel now available. With the cost of oil trending upward, MacInnes expects even greater savings in the future. Moreover, oil companies are unwilling to contract long-term delivery at a firm price.

The 750,000 tons of coal will be burned at Gannon Station in the first two 120-Mw units—one scheduled for completion in 1957 and the other, in 1958. No fuel commitment has been made for other units at the new plant which may add 600 Mw more.

500-kw Unit Rolls for Wisconsin P&L

Wisconsin Power & Light Co has acquired a new 500-kw mobile diesel generating unit to supply power to small communities and rural lines when the regular power source has been cut off by storm damage or has been disconnected to permit repair or replacement work.

The new unit can be transported to trouble spots in the company's territory, and power can be supplied at either 2,400 v or 4,100 v. Auxiliary equipment will be added to permit serving 7.2-kv or 12.4-kv circuits.

The semi-trailer housing the generator is 33 ft long and is moved by a tractor at speeds up to 35 mph. The entire unit weighs 36 tons. The 500-kw generator is driven by an eight-cylinder, 720-hp diesel engine. Cost of the unit was $75,000.

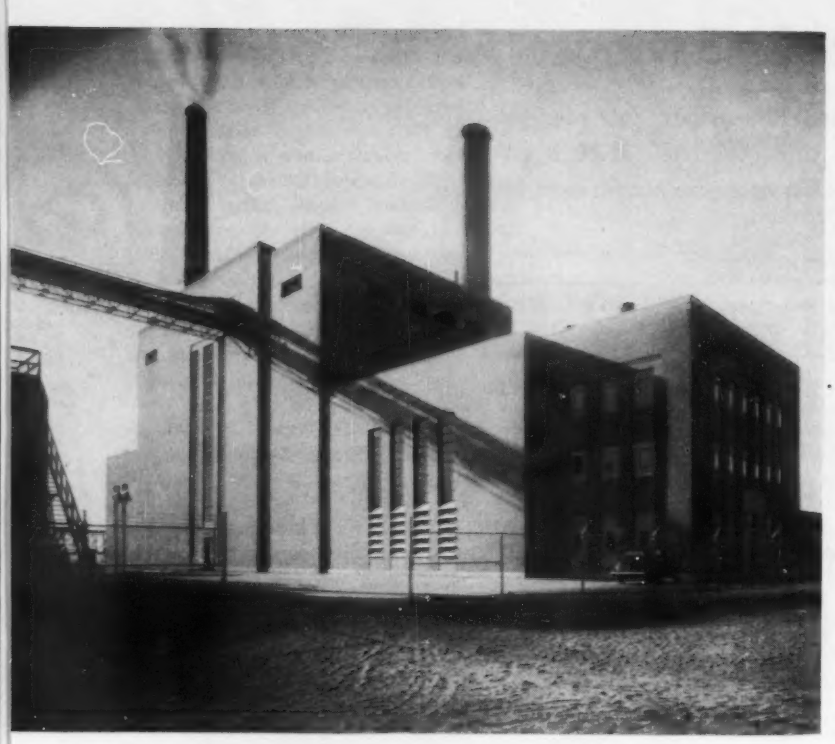
'Pump Storage' Study Set by Union Electric

A "pump storage" water power method which may ultimately provide 1,600,000 kw of additional generating capacity is being studied by Union Electric Co, St. Louis, Mo.

The method consists of producing hydro power during week-day peaks by the fall of water from an upper lake through water-wheel generators into a lower lake. Then, during off-peak night hours and weekends, the water is pumped back up into the higher reservoir by motors using steam-generated electricity.

The company estimates that 3 kwhr of off-peak steam generation would be needed to produce 2 kwhr of daytime hydro power. If the project proves feasible, the conservation prospects of the re-cycle method will further interest utilities in water-conscious areas.

The project will initially call for construction of two dams on Establishment Creek, 50 miles south of St. Louis, if geological and economic studies are favorable. The first dam, at the creek's entry into the Mississippi River, would hold water drained from the Mississippi at high water time. The other dam, seven miles upstream and backing up water pumped from the lower lake, would generate 800,000 kw for on-peak usage. A third dam, a few more miles upstream, would produce another 800,000 kw.



NOW PART of Pennsylvania P&L system, Scranton's Suburban steam station has 71,000 kw capacity

Mergers Give PP&L New Look

- **Scranton Electric, Penn Water add customers, and new capacity**
- **PP&L's plant account increased $111 million to over $534 million**

Completion of proceedings that began in mid-1953 finally saw consumation on Jan. 31 of the merger of Scranton Electric Co into Pennsylvania Power & Light Co. Several months earlier, proceedings that had begun in October 1954 had seen Pennsylvania Water & Power Co become part of the PP&L system. One of the larger mergers of recent times among utilities, the new properties have brought these changes to the PP&L system:

- Added close to 100,000 new customers to bring PP&L's total up to 681,330.
- Added 388,700 kw of capacity (182,700 kw from Scranton and 206,000 kw from Penn Water) to give PP&L total of 1,319,000 kw of capability.
- Increased company's plant account by $111 million to give it a total of over $534 million.
- Added 567 sq mi of territory to give PP&L a 10,000-sq mi service area with a total population of about 2,120,000.

The territory previously served by Scranton now is the Scranton division of PP&L with offices in the former Scranton Electric headquarters building.

C. F. Nagle, former Scranton president, continues as a director of PP&L. Douglas J. Connell, formerly vice president and assistant general manager of Scranton, has been appointed vice president of the newly formed division. L. H. Heineman, former secretary-treasurer of Scranton, is now assistant treasurer of PP&L.

Scranton's revenues before the merger had been derived about 40.4% from residential consumers, 15.9% from commercial consumers, 24% from industrial consumers (excluding anthracite mining), 14.2% from anthracite mining, and 5.5% from others.

Revenues from the anthracite mining industry have shown a steady long-term gain largely from the increased mechanization and electrification of the operations. It has taken place despite continued reduction in anthracite production. As a result of a marked trend towards purchase of power in substitution for consumer generation of electricity, revenues from this class of service are expected to remain comparatively substantial.

Communities in Scranton's anthracite territory have succeeded in having many manufacturing companies locate plants in the region and are obtaining a greater industrial diversification. Over the past ten years the operating revenues of Scranton from industrial consumers in this area, other than anthracite consumers, have more than doubled.

This is a trend which can be expected to gain momentum as the Scranton area benefits from the long experience and stepped up activity of PP&L in area and industrial development. Pres Chas. E. Oakes has

FORMER SCRANTON PRES C. F. NAGLE NOW IS PP&L DIRECTOR

PENNSYLVANIA POWER & LIGHT PRES CHAS. E. OAKES

noted, for instance, that additional area development training has been given to over 375 employees so that they can assist local communities to attract more industry.

Scranton's generating facilities are interconnected with PP&L through 66-kv lines and these are being augmented by a new 220-kv transmission line.

Penn Water was purely a generating and transmission company, selling power in bulk. But its facilities, together with those of Scranton, give PP&L important capacity additions and much better balance in the location of generating sources. Also important is the fact that through the Penn Water merger and subsequent contracts, one-third of the plant capacity of the Safe Harbor Water Power Corp's hydro plant near Holtwood has, in effect, become part of the PP&L system.

Over 100,000 kw of Penn Water capacity was committed to neighboring utilities at the time of the merger. Most of this capacity will become available to PP&L during 1957, and it will all be available by mid-1958. Various high voltage transmission lines connecting the Holtwood and Safe Harbor plants to Philadelphia Electric Co, Metropolitan Edison Co, and Baltimore Gas & Electric Co are also now part of the PP&L system.

Oakes looks for considerable saving in operating and capital costs over the next few years as a result of the mergers.

The PP&L area is experiencing rapid growth. To keep pace with this the company will spend $157 million on new construction over the next five years. Of this $32.8 million will be spent this year as against $31.4 million last year. The newly acquired generating capacity will be augmented this year with the completion of the 132,500-kw second unit of the Martins Creek plant.

By 1962 atomic power may be a part of the PP&L system. The company is working with Westinghouse Electric Corp on the development of a 150,000-kw homogeneous reactor which, if present plans mature, may be in service by 1962.

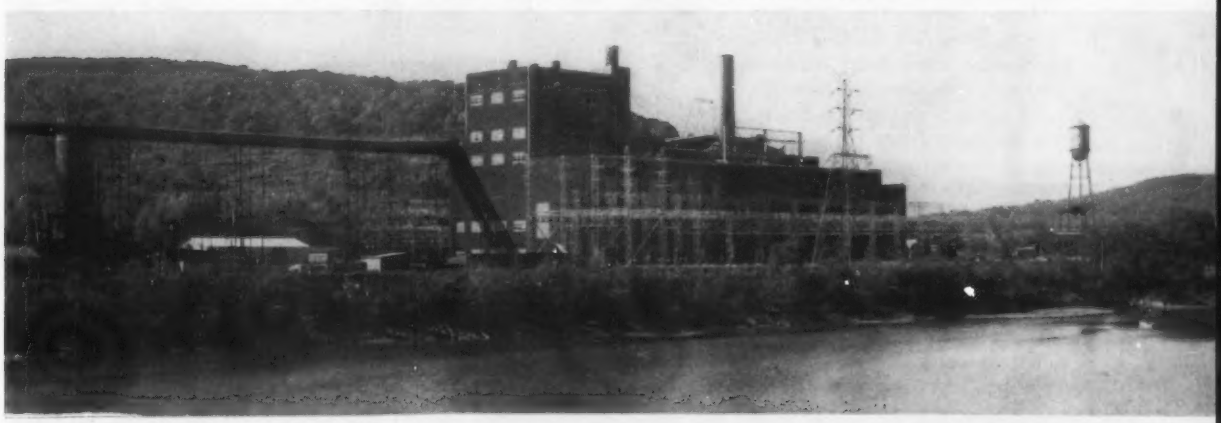
PP&L continues active promotions in a number of fields which ensure maintenance of the rapid growth rate the company is experiencing. Of significance here is the industrial development activity which had its most successful year in 1955 by bringing 122 new firms into the territory. The company also sponsored forums for industry representatives on automation, pointing out means of increasing productivity and lowering product costs.

Schools on modern applications of electric heat were conducted for improving production efficiency and product quality. These and many other promotions augur well for the future of the area.

Customer growth is continuing at a rapid rate and the company expects to have 732,500 customers by 1960. Average residential and farm customer use of electricity last year rose 8.5% over 1954 to 2,493 kwhr. By 1960 the figure is expected to be 3,560.

Earnings last year were $3.10 a common share on 5,916,824 common shares outstanding at year end (including Scranton and Penn Water proforma) compared with $2.88 a share on 5,659,095 shares outstanding at end of 1954.

SCRANTON'S STANTON STEAM PLANT ADDS 147,000 KW TO PP&L SYSTEM



System Interconnections Top

. . . program of PEA Electrical Equipment Committee. PP&L and Met Edison substation designs seen as progressive

Interconnection facilities at 230 kv between Pennsylvania P&L's Hummelstown Substation and Metropolitan Edison's Middletown dominated Pennsylvania Electric Association's Electrical Equipment Committee meeting at Harrisburg, last month. Both stations were studied as examples of progressive design.

Structural simplicity and strain buses on suspension insulators gave Hummelstown clear working space. Its two main banks, each 75-Mva 230-66-kv OA/FA units, were delivered to the site by railroad spur. Control is entirely automatic and supervisory.

Somewhat similar designs at Middletown applied strain buses to connect two 37.5-Mva 230-115-kv OA/FA units. This station also is under supervisory control.

Survey Safe Designs

Survey results showed extensive areas of agreement in methods of designing operating safety into substations. Reported by R. C. R. Schulze, Atlantic City Electric Co, were:

1. Minimum of 8 ft from ground level to base of bushing.
2. Little inclination to provide permanent access ladders to fuses.
3. Extensive use of group-operated manual grounding switches.
4. Ground assembly of portions of the substation structure.
5. Almost universal use of tape barriers to define safe working areas.

But Schulze urged more attention to grounding practices for manually operated switches and station fences. Replies for these facets revealed extensive variations.

Another survey by B. B. Kern, Pennsylvania P&L Co, revealed wide variations in inspection and maintenance programs for electrical equipment. Air-break switch inspection schedules range from yearly to every five years. Oil circuit breakers run 6 months to 3 years, and several utilities use number of operations as the criteria. Station transformers range up to 10 years between oil tests and 20 years between overhauls.

A. F. Phillips, Duquesne Light Co, urged careful study to gain operating economies in scheduled inspection and maintenance, particularly by eliminating troublesome features from equipment designs.

Power transformers of the future may use sulfur-hexafluoride as a coolant instead of oil, implied L. H. Hill, Jr, General Electric Co. Already a 667-kva 69-kv prototype has been built for two 2,000-kva units to be installed by Con Edison. A 138-kv prototype is under development, and 10/12.5-Mva OA/FA distribution substation units are contemplated.

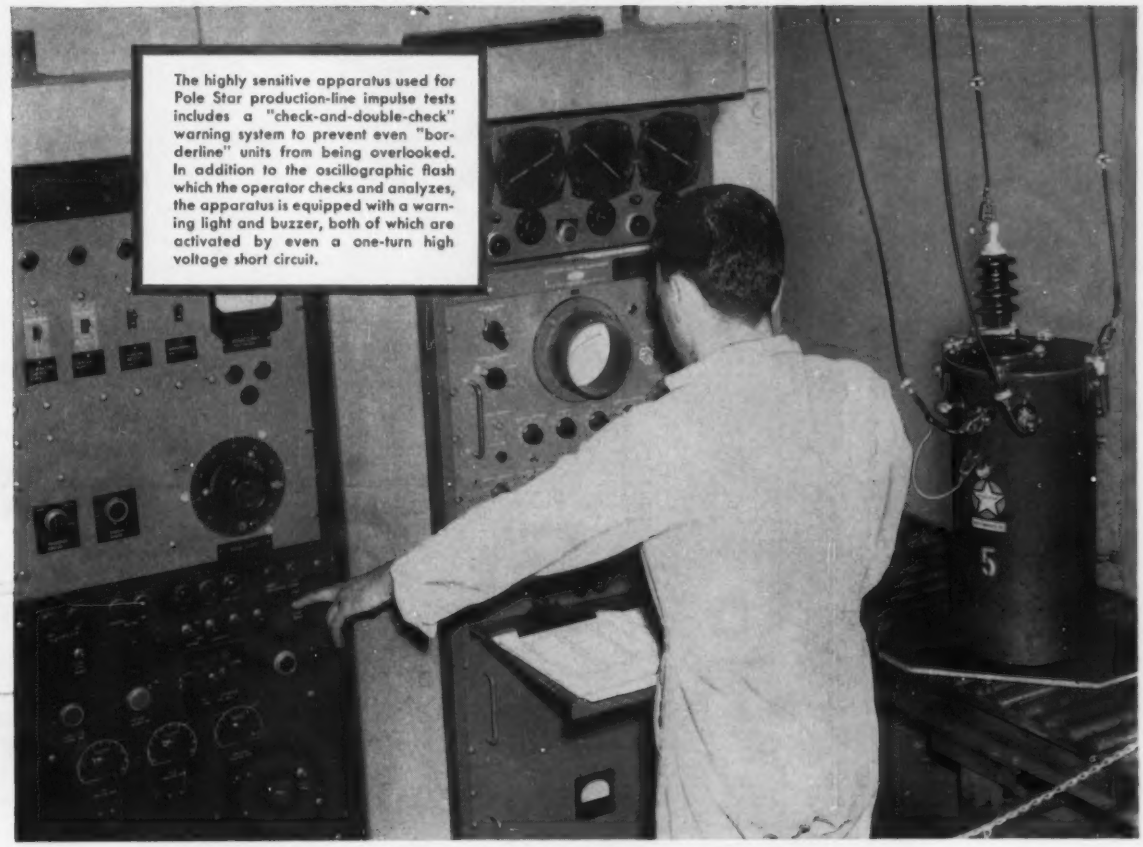
Other innovations in transformer design were revealed by G. A. Monito, Westinghouse Electric Corp. Nitrogen-cooled units up to 2,000 kva are not uncommon, he said, and design is being extended to 3,000 kva. But future developments will apply perfluorocarbon liquids to gain dielectric strength and thermal capacity. Experimental application of this new vapor-coolant to a 50-kva transformer enabled it to carry 330% load continuously without insulation damage.

Floods may not involve as great an area as hurricanes and sleet, but the destruction they cause may be more severe, said D. A. Campbell, Pennsylvania P&L Co. The record flood last August involved 994 mi of lines, 5 substations, 1 hydro plant, and 45,292 customers. But restoration was speeded by applying a well-formulated disaster plan.

Rehabilitation of flooded substations was discussed by S. D. Henry, Metropolitan Edison Co. He spoke specifically about two installations at Easton. (EW, Feb. 13, p 46).

Procurement of qualified engineering graduates remains difficult. E. B. Shew, Philadelphia Electric Co, described his company's program for reaching students before graduation and for continuing their training after employment.

NEW ENGINEERING SECTION CHAIRMAN A. C. Hartranft, center, Philadelphia Electric, is complimented by Electrical Equipment Committee Vice Chairman E. M. Gue, Duquesne Light. J. S. Davidson, Penn. P&L vice president, looks on



The highly sensitive apparatus used for Pole Star production-line impulse tests includes a "check-and-double-check" warning system to prevent even "borderline" units from being overlooked. In addition to the oscillographic flash which the operator checks and analyzes, the apparatus is equipped with a warning light and buzzer, both of which are activated by even a one-turn high voltage short circuit.

He's checking the POLE STAR's impulse before giving it a clean bill of health

After Pole Star distribution transformers have passed all required ASA and NEMA tests*, they are given a series of final checks to make absolutely certain they are just as dependable as their name implies. Every Pole Star from 3 through 100 kva, 18 kv and below is *completely impulse tested without arresters* — being subjected to production-line tests that simulate the impulse surge conditions likely to occur throughout the entire transformer during actual service.

Such thorough testing of each Pole Star's resistance to impulse surges is accomplished by checking the effect of surges between layers and turns as well as to ground.

The apparatus used for detecting failures during these tests is so sensitive that it will disclose *even* a one-turn high voltage short circuit.

This rigid quality control — typical of Pennsylvania's production methods — means added years of trouble-free service with Pole Stars, and important reductions in maintenance.

**ASA and NEMA standards require tests for winding resistance, winding and tap ratio, polarity and phase relation, core loss, exciting current, copper loss, and impedance, as well as applied and induced voltage insulation tests. These represent only a partial listing, however, of the numerous tests — both mechanical and electrical — which Pole Stars and their component parts and materials must undergo.*

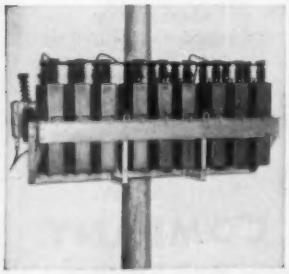
167 Production Controls make Pole Star Best!

PENNSYLVANIA TRANSFORMER COMPANY

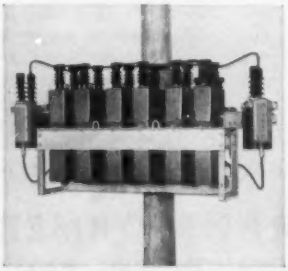
A McGraw Electric Company Division **CANONSBURG, PA.** *Greater Pittsburgh District*

Pole Star Transformers are available in all standard single phase distribution sizes from 3 through 500 kva, through 67,000 volts.

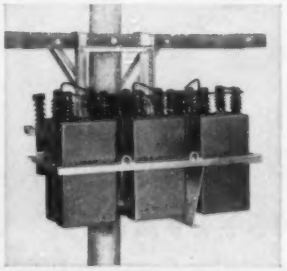
L-M's new 50 kvar capacitors are now available in 600 *kvar switched capacitor racks.* Assembly weighs only 43% more than a 300 kvar rack. Capacitor unit has same width, same thickness as a 25 kvar capacitor and will fit into existing NEMA standard hangers and L-M single-row racks.



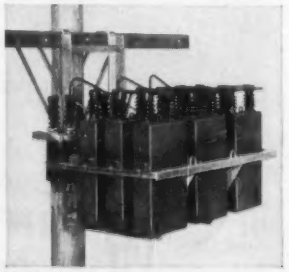
450 kvar single-row switched capacitor rack with L-M's Elemex 50 kvar capacitors. Weighs only 12% more than a 300 kvar single-row rack with 25 kvar capacitors.



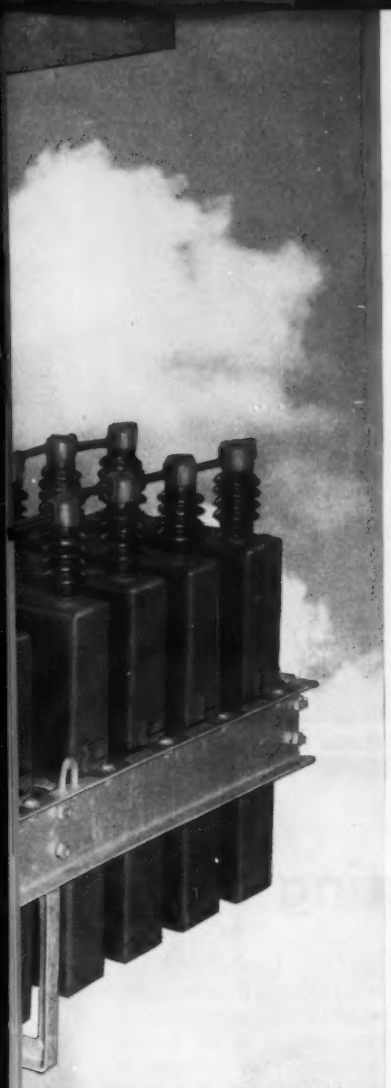
300 kvar single-row switched capacitor rack with L-M's Elemex 50 kvar capacitors. Assembly is quick and easy to install, inspect, and maintain.



300 kvar multi-row switched capacitor rack with L-M's 50 kvar capacitors. Switched racks are supplied with dependable L-M Kyle type NR oil switches.



450 kvar, 2400 volt multi-row switched capacitor rack with L-M's 50 kvar capacitors. Weighs only 150 pounds more than a 300 kvar rack with 25 kvar capacitors.



L-M's New 50 KVAR Capacitors Provide Greater Capacity Per Pole

Offer less weight and less pole space per KVAR

By **N. K. DELANEY**
Product Manager
Capacitors and Regulators
Line Material Company

Now you can hang capacitor racks of larger capacity on a pole with L-M's new 50 kvar Elemex® capacitors. Racks are factory-assembled and wired, shipped ready to install on distribution systems rated 2400 to 13,800 volts, multi-grounded wye. Bank sizes may be up to 450 kvar switched, 600 kvar unswitched multi-row racks, and up to 600 kvar switched or unswitched single-row racks.

Less Weight per KVAR

Line Material's new 50 kvar, 2400 volt capacitor weighs 109 pounds compared to 68 pounds for a 25 kvar unit. A 600 kvar, 2400 volt unswitched multi-row rack weighs only 51% more than a 300 kvar rack, and a 600 kvar, 2400 volt switched single-row rack weighs only 43% more than a 300 kvar rack.

Less Space per KVAR

L-M's new 50 kvar unit has the same width, same thickness as a 25 kvar capacitor and only 10 inches of additional height. It fits into existing NEMA standard hangers and into L-M's present single-row rack. Capacity of a single-row rack can be *doubled* with L-M's 50 kvar capacitors. A 450 kvar single-row switched rack with 50 kvar capacitors is approximately 2 feet narrower than a 300 kvar rack with 25 kvar capacitors. Handling, installation and maintenance costs per kvar have all been reduced with L-M's new 50 kvar unit.

Other Features of L-M's Elemex Capacitors and Capacitor Rack Assemblies

Elemex capacitors are individually dried and completely impregnated under vacuum with low-temperature Elemex liquid dielectric.

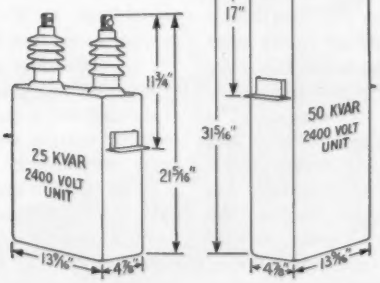
Unit has strong solder-sealed bushings of one-piece wet-process porcelain, "Paragroove" clamp-type connectors, and aluminum metallic coating under alkyd resin paint.

Assemblies have only one plug-in connection point per phase for control wiring, and one terminal box for all three phases.

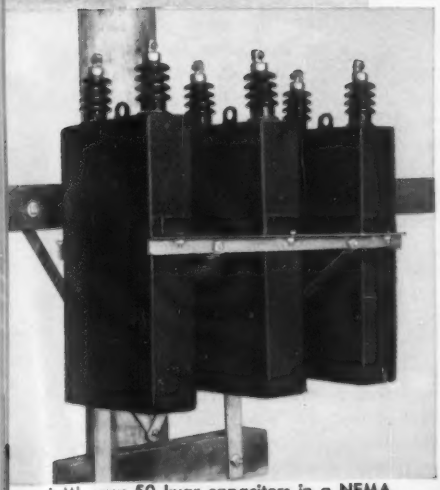
Assemblies are of complete bird-proof construction; terminals have neoprene rubber caps, plus 5 kv insulated conductor for high-voltage connections.

Get Complete Information

Ask the L-M Field Engineer for information on features, design, and delivery on the new 50 kvar Elemex capacitors and capacitor equipments. Or write Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).



Only 10 inches of additional height gives twice the capacity.



L-M's new 50 kvar capacitors in a NEMA standard hanger. The capacitor has the same width, same thickness as 25 kvar capacitor and 10 inches of additional height. The three units provide 150 kvar—50% more than four 25 kvar units.

LINE MATERIAL

Elemex® Capacitors

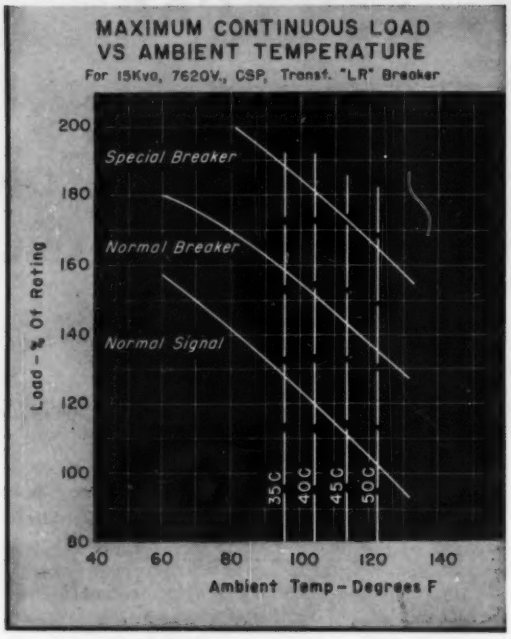


FIG. 1—SPECIAL BREAKER SETTINGS for CSP transformers allows greater difference in load between red light signal and breaker opening

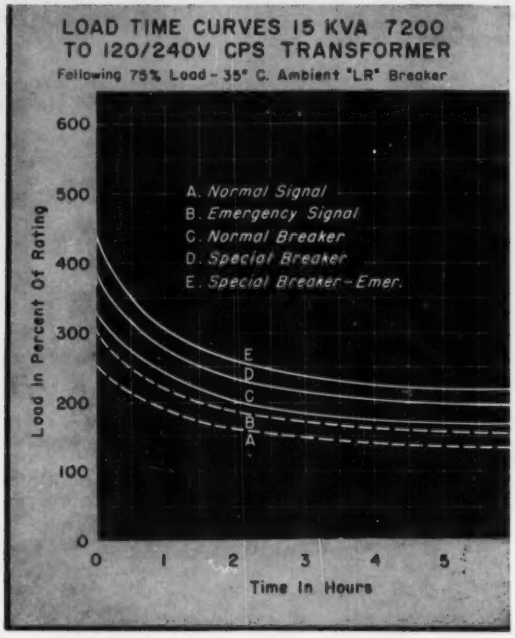


FIG. 2—SPECIAL BREAKER SETTINGS also allow more time between overload signal and breaker opening to allow time for providing more capacity

Use Higher CSP Breaker Setting

J P BARRON, Head Substation & Transmission Division, Engineering Department, Dallas Power & Light Company, Dallas, Texas

In order to allow more time between the overload signal and breaker tripping on CSP transformers, Dallas Power & Light Co has increased the breaker settings by approximately 30% of the nameplate ratings. New transformers are being ordered with this setting.

It has been our practice since the rapid postwar load growth started to patrol the system for overload signals after the first hot period in the summer. This patrolling is repeated after each unusually hot period during the summer. As each overload signal is discovered, the bus is resurveyed; and adequate transformer capacity is installed. This plan of operation was not allowing time to discover the signal and provide adequate capacity before some of the transformer breakers opened, causing an interruption to service.

The problem is aggravated by the high ambient temperatures which cause and accompany maximum load on the transformers. With an ambient temperature of 50C, which can be obtained with a transformer in the summer sun, the overload signal will operate at 100% load; and the breaker will operate at 135% load as shown in Fig. 1. This allows a very small margin of error in predicting the load and in installing additional capacity ahead of a growing load.

For a 35C ambient temperature, if a transformer enters the hot season with a potential of 170% load, when the load is realized, the overload signal trips in 1½ hours; and the breaker opens in 6 hours, as shown in Fig 2. This does not give sufficient time for adding transformer capacity. If the ambient is higher than 35C, the overload margin and time margin become progressively smaller.

In an effort to reduce customer outages, a large number of transformers was added to the system at a very expensive rate. In doing so, the company felt that the most economical use of transformers probably was not being attained. There was also an excess of smaller size transformers in stock, and these were becoming more difficult to put into system use.

In an effort to solve these problems, after consulting the manufacturers, the breaker settings on all existing CSP transformers were increased by approximately 30% of the name plate rating. All CSP transformers are being purchased with the higher breaker setting, a setting which approximates the operation of the breaker in the past after the emergency lever had been thrown. Wherever possible the overload signal is set at the normal setting. The resulting operation of the breaker is shown typically by Figs 1 and 2 which are drawn for a 15-kva transformer. An emergency setting is provided which is higher than this new standard setting. This, too, is shown on Fig 2.

This program was begun during the summer of 1954 and continued in 1955. It is too early to have accumulated statistics on the operation of the transformers with the special breaker settings, but the indications are that considerable improvement in customer interruptions and some improvement in distribution transformer economy can be expected.

Have you seen the NEW Chance Side Break Switches?

Desk-top model demonstrates features that make this high-pressure contact switch easy to install, easy to operate, and able to withstand extremely high fault currents.

TOM CURTIS, Chief Switchgear Engineer, and CHUCK LIMING, Switch Sales Manager, discuss features of quarter scale demonstration model of new Chance Type S Switch.

The Chance Type S Side Break Switch has everything that utility engineers have asked for in a ruggedly-built, economical switch for sectionalizing, disconnecting, by-passing and isolating applications. It was designed to combine ease of installation and operation with the high mechanical strength and thermal capacity necessary to withstand, without damage, the extremely high fault currents possible on today's systems. It passes every test.

If you haven't seen it, a letter, post card, or phone call will bring a Chance representative with a desk top demonstration to show you how this Chance Switch has the simplicity of installation, ease of operation and freedom from costly maintenance that you've looked for in the switches you buy.

High pressure, self-wiping silver to copper contacts.

Sealed high pressure, silver to silver permanently lubricated hinge contacts.

Braidless current path. Sealed high pressure, silver to silver permanently lubricated hinge contacts.

Independently bolted auxiliary crank can be adjusted to within 2½° of any desired position.

Sealed, greaseless ball bearings of stainless steel in stainless steel races assure smooth operation.

RATINGS

400 Ampere—7.5 KV through 34.5 KV
600 Ampere—7.5 KV through 69 KV
1200 Ampere—7.5 KV through 69 KV

ABC INDUSTRIES

A·B·CHANCE CO·

CENTRALIA, MISSOURI

San Francisco, California • Pittsburgh, Pennsylvania

CS5A-3

COMPUTER CONSISTS of 35 separate units, some of which are shown here. Heart of machine is L-shaped Central Processing Unit in foreground

Commonwealth Edison Starts

PAUL W. BOYER, Manager of Accounting, Commonwealth Edison Co, Chicago, Ill.

Over a million Chicago customers of Commonwealth Edison Co—although they don't know it—are taking part in a major billing change. Already 100,000 customers have received new and different bills.

These bills look just like the old ones, but they were prepared very differently. For the first time in the history of the utility industry, automation is taking over completely a massive and exacting billing and bookkeeping operation.

Nearly 10,000 accounts are being converted daily to the new system, which uses International Business Machine's Type 702 electronic data processing equipment. This conversion from conventional accounting equipment to the 702 will continue through the month of August, 1956. It is planned that by then all of the 1,060,000 Chicago customers will be billed on the new computer.

Commonwealth Edison expects to acquire IBM's newer and faster Type 705 computer late this year. The 705 will take over billing operations from the 702 by June of 1957. It is anticipated that the 705 will process bills of the 1,860,000 customers in the whole Edison territory in less time than the 702 takes to bill Chicago customers alone.

Edison expects that by 1958, when all of the accounts are being processed on the 705, personnel required in the Revenue Accounting Department will be reduced from 480 to 280, making 200 people available for other work throughout the company.

The savings under the new system are estimated at $750,000 per year before federal income taxes. Further savings should develop as the speed, capacity, and flexibility of the computer are brought to bear on other problems and processes.

COMPLEX mechanism of computer requires constant maintenance and supervision of trained engineers

ELECTRONIC COMPUTER is directed from console. It serves both as input and output unit; includes electronic typewriter for special uses

Electronic Billing

Commonwealth Edison's installation of the 702 computer climaxes a long history of mechanization in its accounting operations. Punched card equipment, first installed in 1910, was applied to the billing operation in 1932. Over the next fifteen years, mechanization was gradually extended to the general accounting organization.

Finally, between 1947 and 1949, a new mechanized billing procedure was adopted, based upon a marksensed meter reading card and a postcard bill with pre-punched stub. As a result of these developments, the number of financial and accounting employees has declined since 1930, while sales have quadrupled. At the same time the number of accounting offices has been reduced from 38 to 2. Ultimately the computer will permit reduction to one.

By 1950 centralization and mechanization of accounting activities had laid the groundwork for automation. At that time Commonwealth Edison became interested in the possibilities presented by the large-scale computers. After four years of careful study, the IBM 702 was ordered in 1954 and delivered in July of 1955.

Initial studies were made to determine whether accounting activities were by their nature suitable for computer processing. Careful analysis was necessary to determine the economics of the new process. Before committing itself, company management had to be completely sure that all significant details of its operations could be incorporated into a rapid and effective system on the computer.

Results were favorable and indicated that billing activities, because of their volume and repetitive nature, were particularly suitable for computer application. Analysis of the billing operation became even more detailed and painstaking. It was found that the impact of the computer would extend throughout the entire billing system into areas not previously affected by mechanization. Finally a program was prepared and tested out on IBM's factory model early in 1955.

BILLING MACHINE, operating with cards turned out by computer, makes first transfer of electronically-computed data to company bill forms

Magnetic tapes are now used to file records. One 10½ inch reel stores information formerly contained on 25,000 cards

Installation of the 702 in July of 1955 was followed by an intensive period of program testing and revision, together with short trial runs on the computer to check out both the system and the equipment. Because of internal self-checking, reliability of the computer system is expected to surpass that of the conventional equipment. Under such circumstances, however, the program itself must be exhaustively tested.

In late 1955 the computer began operating in parallel with existing equipment for certain groups of bills as a final check on the accuracy of the new system. Conversion of customer accounts to the new system is now proceeding on the scheduled basis. Also, plans are being developed for the conversion of payroll, material accounting, and general accounting to the 705 in 1958.

Commonwealth Edison plans to use its electronic computer extensively in non-accounting operations. The speed and capacity of the machine makes it particularly suitable for complex engineering problems which either cannot be handled in detail at present or can be solved only after many hours of manual calculation. The capabilities of the computer are also being used by Commonwealth Edison in its expanding operations research activities.

Several lessons can be learned from Commonwealth Edison Company's experience.

First, the initial planning job was bigger than expected. Because the field is brand new, many unanticipated problems were encountered. Several times it has been necessary to revise completed programs in the face of new developments.

Edison originally estimated that it would take 20 man-years to program the billing job. The actual time was thirty-five man-years. Similarly, the amount of time for "debugging" the programs—eliminating all inconsistencies and errors—was considerably in excess of what had been estimated. Although these factors resulted in only a two and a half month delay in the conversion schedule, they created many headaches and put a heavy burden on programming personnel.

Second, the importance of experienced personnel cannot be over-emphasized. Because of its background of mechanization, Edison was fortunate in having experienced machine procedures analysts available as the core of its programming and evaluation group. These analysts were supplemented by personnel from operating areas affected by the computer, as well as by specialists from IBM and the Company's independent accountants.

Work of this type requires an unusual blend of experience, imagination, ability to organize and systematize, and exhaustive attention to detail. Because of the newness of the field no reservoir of trained manpower exists on which to draw. Nonetheless, the success of the entire operation depends upon the abilities of the personnel involved.

As programming difficulties developed at Commonwealth Edison, the unavailability of additional trained personnel with the necessary aptitudes placed a definite strain on all those involved in the operation. Consequently, Edison has recently expanded its computer programming and planning staff from 14 to 30 men, and expects to train even more people to do this work. A company which is thinking in terms of automation cannot begin too early to familiarize personnel with programming work.

The 702 Computer and How it Handles Commonwealth Edison's Customer Billing

The heart of the 702 system is the central processing unit. This consists of arithmetic and logical circuits, electrostatic memory storage and two accumulator storage units.

The arithmetic and logical unit does the computer's arithmetic and makes the decisions which control the course of its operation. In one minute it can perform 237,000 additions, 50,000 multiplications or 9,000 divisions involving five digit numbers. It takes less than one five thousandth of a second to reach a decision.

The memory portion of the central processing unit contains 84 cathode ray tubes. By means of electrostatic charges, 10,000 characters of information or instruction can be stored on the inner faces of these tubes. The records stored in the memory unit may be referred to and used repeatedly during the course of a problem.

The two accumulators also employ cathode ray tubes to store 512 characters each. They provide temporary storage of data on which operations may be performed without changing the original record in memory.

Data and instructions are read into the computer from magnetic tape or from punched cards. Finished information is obtained from the central processing unit by recording on magnetic tape, punching into cards, or printing directly onto paper records.

Magnetic Tape Used

Because of the speed with which it can be processed, magnetic tape is generally used for both input and output purposes. Separate card-to-tape or tape-to-printer operations can be performed without interfering with the functions of the central processing unit.

Commonwealth Edison's installation has 17 tape units, each of which holds a reel of tape 2,400 feet long and half an inch wide. One reel of tape can hold the equivalent of 25,000 eighty-column punch cards if each record is eighty characters long. A tape unit can read or record data at the rate of 15,000 characters per sec.

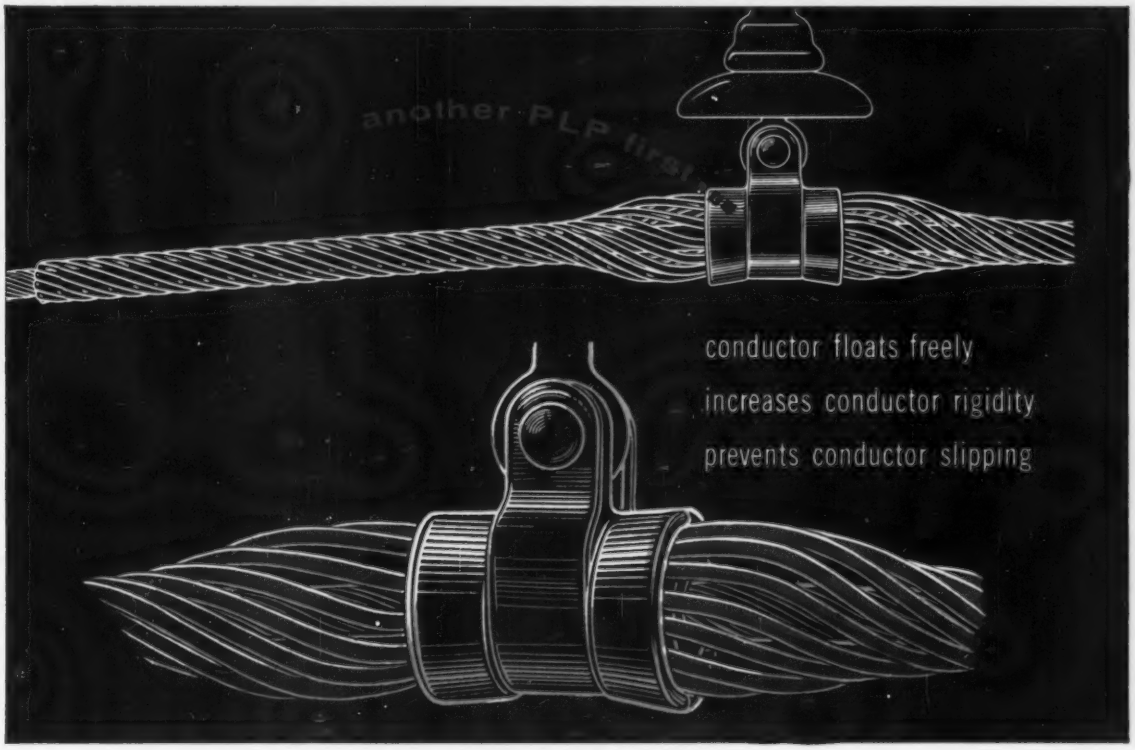
Other auxiliary components of the computer system include two card readers, two card punches, and two printers.

Card readers read information into the central processing unit from punched cards at the rate of 250 cards per minute. Card punches, punch output data into cards at the rate of 100 cards per minute. Printers record data at the rate of 150 lines per min.

Each printed line is 120 character spaces long. Newer models of printers will print 1,000 lines per min.

Operation of the 702 is controlled

(*Continued on page* 30)



an entirely new concept in suspension design

After five years of intensive laboratory research and field experience, Preformed Line Products Company announces the ARMOR-GRIP SUSPENSION. This is not just a modification of the conventional clamp—in fact, in a sense it is not a "clamp" at all. The ARMOR-GRIP SUSPENSION is a "floating suspension"—the conductor is cradled in neoprene and firmly gripped only by the custom-designed Preformed Armor Rods which distribute their pressure over a relatively large area. An ingenious relation between rods and housing prevents the suspension assembly from slipping longitudinally. The expanded configuration of the PLP rods also adds rigidity to the conductor while slight vertical resilience of the conductor mounting eliminates a steep stress gradient.

THE ARMOR-GRIP SUSPENSION ELIMINATES CONCENTRATED CLAMPING STRESSES.

In severe accelerated vibration tests, conductor mounted in the PLP ARMOR-GRIP SUSPENSION outlasts conventional clamp assemblies many times—in fact, no conductor failures have ever occurred under the ARMOR-GRIP SUSPENSIONS in these tests. Thousands of ARMOR-GRIP SUSPENSIONS have been installed during the past four years—with NO reported case of unsatisfactory performance.

Yet with all these functional advantages, the ARMOR-GRIP SUSPENSION is very easy to install. Simplicity of design has eliminated many parts—there are less than one-half the number contained in a conventional clamp assembly. Only one nut to tighten.

The ARMOR-GRIP is immediately available in conductor sizes in the ranges of 336,400 cm, 477,000 cm, 795,000 cm, 954,000 cm ACSR and All-Aluminum. Other sizes will soon be available and can be produced on request.

Made in accordance with or for use under one or more of the following U. S. Patents: 2,722,393; 2,275,019; 2,587,521; 2,609,653; 2,691,865; other patents pending.

PREFORMED LINE PRODUCTS COMPANY
5349 ST. CLAIR AVENUE • CLEVELAND 3, OHIO
TELEPHONE: CLEVELAND EXPRESS 1-3571

Super power transformers pace utility expansion

"Big Power" Transformer goes to Long Island

THIS 125,000-kva Allis-Chalmers power transformer is in operation at the Far Rockaway generating station of the Long Island Lighting Company. It is a typical example of the power transformers being built by Allis-Chalmers for utilities all over the country.

As power needs grow, utilities are adding more and more of these big transformers to their systems. Allis-Chalmers has helped in the development of new transformer engineering and construction techniques to aid utilities in solving their expansion problems.

Here are some of the features worth noting:

Quiet. This transformer was built to operate at 76 decibels. Normal sound level for a transformer of this type would be at least 85 db. Continuous noise research includes a 10-acre outdoor proving ground, mobile testing equipment, and extensive laboratory facilities for testing and analysis.

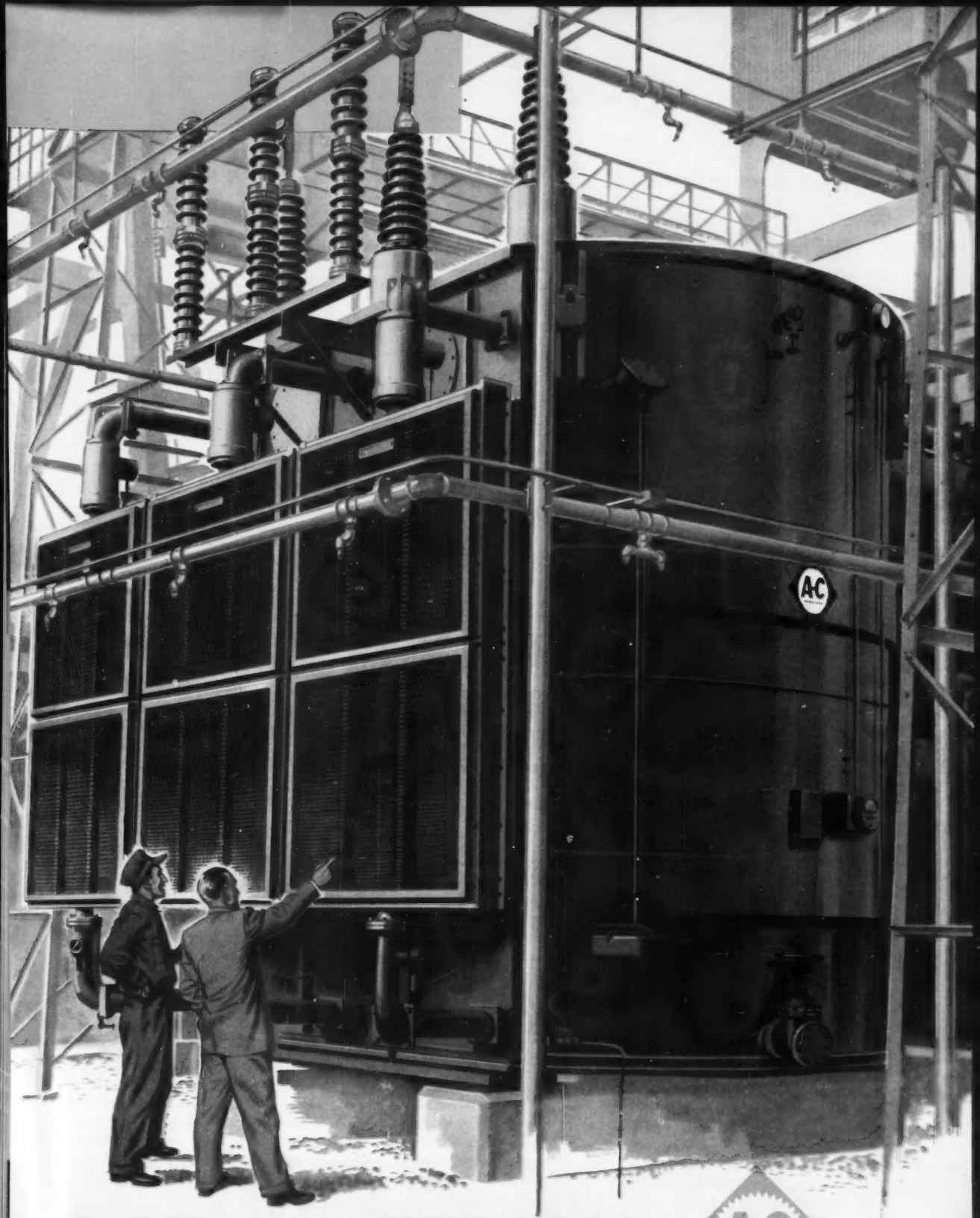
Cool. This transformer is cooled by *Electro-Coolers*, consisting of air-to-oil radiator-type heat exchanger and pump, which provide high efficiency heat transfer.

Corona-Free. Like all Allis-Chalmers power transformers, it is corona-free. Regardless of size or number of parts, the creeping deterioration of corona can never shorten the useful operating life of an Allis-Chalmers power transformer.

An Allis-Chalmers representative will be glad to discuss this or other power transformer developments with you at your convenience. Call the nearby A-C office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin. A-4913

NEW ERA
IN POWER
TRANSMISSSION

ALLIS-



CHALMERS

A-C
ALLIS-CHALMERS

Computer Handles Billing

(*Continued from page* 26)

from the operator's console, which permits complete supervision of the machine's activities. Machine progress is indicated on the console panel, where each operating phase is indicated by lights. Manual control is provided through a series of operating switches, as well as a keyboard which can be used to insert instructions or revise the contents of memory.

The operator's console includes a type-writer which can be used to print information out of the computer at the rate of 600 characters a min.

Operations Combined

The computer is operated by inserting into its memory a sequency of instructions which are used to process each record. The capacity of the computer and the speed and flexibility of its input-output devices make it possible to combine into one sequence of operations a large number of sub-routines which under the old system have been processed one by one. It is possible to build alternative courses of action into the instructions. These can be selected according to the characteristics of the individual record. As a result a great number of exceptional situations which formerly required special attention can be handled as part of the main operation.

When complete information and instructions are introduced into the computer for processing a problem they make up a program. Involving several stages of manual preparation, programming begins with a careful analysis and outline of the problem to be solved. This analysis is then interpreted in terms of the 32 basic operations which the 702 can perform.

Has Repetitive Feature

After the preparation of coded instructions, operations are arranged in combinations and sequences necessary to produce desired results. Programs can be read into the 702 by either punched cards or magnetic tape.

The program which controls the computer's billing activities contains 85,000 separate instructions and took 35 man-years to prepare. However, now that it is completed it can be used over and over again. It is this repetitive feature, together with the computer's enormously fast processing speed, which makes the 702 such a powerful business instrument.

As handled by the conventional system, Commonwealth Edison's billing requires the maintenance of large volumes of punched cards and many manual records to provide necessary information for billing 1,845,000 customers, posting payments and maintaining accounts, providing historical reference data, and preparing financial and statistical reports. The new 702 system consolidates into one file the many records presently maintained separately. The 702's "Customer Record File" is recorded on magnetic tape and shows each customer's name, address, credit status, bill calculating data, historical record of use, and many other items.

Meter readings are obtained as in the past, with current meter readings mark-sensed on individual customer cards. These are processed through accounting machines which convert the meter reader's notations to punched holes.

At scheduled periods, a card reader transfers the punched card records to magnetic tape. These "meter reading tapes" are processed through the computer in conjunction with "customer record tapes." Each meter reading is matched to the corresponding customer record and the bill is calculated.

Report Data Compiled

The bill amount, kilowatt-hours of usage and other related information is recorded on magnetic tape for subsequent printing of bills and billing registers.

When bill stubs, pre-punched with account numbers and billed amounts, are returned with customers' payments, information on the stubs is translated to magnetic tape. At specified periods this new data is processed by the 702 in conjunction with the customer record tapes.

In this manner the 702 automatically processes the billing of customers and the recording of bill payments.

Simultaneously, the computer provides data for financial and statistical reports and prepares reference material to assist in answering customer inquiries.

New Zealand Considers Inter-Island Power Link

The South Island of New Zealand, which has an almost limitless potential of hydroelectric power, may pipe power across the Cook Strait to the power-starved North Island, according to a report by the chief engineer of the Hydro-Electricity Department, G. M. Latta. The strait is about 20 miles across.

Installation of a submarine power cable across the strait is not only technically feasible but economically sound, Latta said. The resultant economic gains would be so large that New Zealand could not afford to turn down the project unless a full and proper investigation which should be carried out immediately disclosed unforeseen difficulties, he added.

POWER BRIEFS

• Cleveland Electric Illuminating Co expects to spend $200 million on new service facilities in the next five years and anticipates an increase in capacity of 1,100,000 kw from 1959 through 1965. Present capacity is 1,564,000 kw.

• Turn-over date for Kansas Gas & Electric Co's Murray Gill Station No 3 unit is planned before June. Completion of the 115,000-kw addition is a major item in the company's $13-million 1956 construction budget.

• Substantial agreement has been reached by Egyptian government and the World Bank on terms of a $200-million loan which would finance second-phase construction of $1.3-billion dam at Aswan on the Nile River. The 15-year hydro project will produce 10-billion kwhr a year and will provide nearly $1 billion in increased national income.

• Pacific Power & Light Co has asked Federal Power Commission for license to build its proposed $56.2-million, 133,000-kw Swift hydro project as third step in development of the Lewis River in southwestern Washington. Project consists of two phases: Swift No. 1, a 140-ft high dam forming a reservoir extending about 12 mi upstream; and Swift No. 2, power canal and forebay extending 3½ mi to dam.

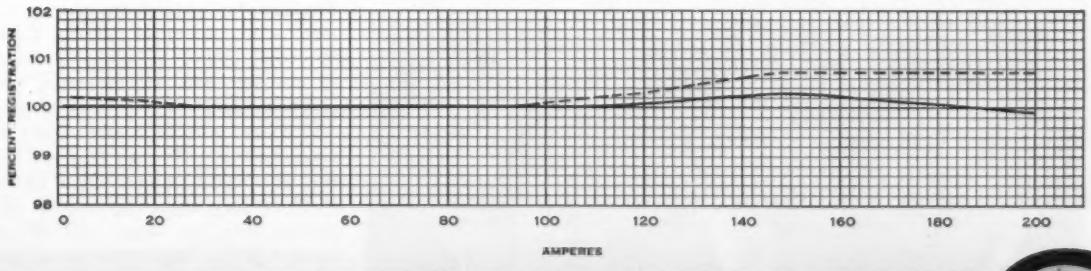
...match your 200 ampere service entrance equipment with Sangamo J2 200 ampere meters

With bigger and bigger loads to handle every day, it makes good sense to match full service entrance capacity with watthour meter capacity.

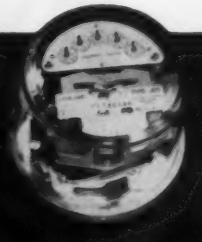
Sangamo J2 50-ampere nameplate rated watthour meters have straight-line accuracy up to 200 amperes.

Torque characteristics of the 50-ampere J2 are high ... 74.0 mmg. at nameplate rating. Average starting watts are low—only 18 watts. Just twice the starting watts of the J2 15-ampere meter.

The straight line accuracy of the J2 50-ampere single-phase will meter your "full use" customers' loads even if their demand goes to 48 KW. Take a look at the chart at the bottom of this page.



JM56-2



SANGAMO ELECTRIC COMPANY

SPRINGFIELD, ILLINOIS

MEETING REPORT

Building Load Factor Emphasized

MVEA's Industrial and Commercial Sales Conference devotes attention to the opportunities to raise utility revenue by selling new power applications

Building load factor was the theme of the meeting of the Missouri Valley Electric Association's Industrial and Commercial Sales Conference, Feb. 2 and 3, in Kansas City. This was the keynote sounded by E. P. Hennek, president of the association in his opening address.

Each sales organization must thoroughly analyze the conditions in its own company in order to do the most intelligent job, Fred M. Kimball, general sales manager, Kansas Gas & Electric Co, told the conference. The object, said Kimball, should be to build net revenue. To do this in the areas of most companies of the association will, he said, mean building load during hours other than hot summer afternoons when most system peaks occur. This, he said, will mean selling electric space heating and getting it accepted by the customer. There are also opportunities for building load factor through sales of lighting, cooking, ice melting, and other equipment that will make maximum use of the company's investment.

Heat pumps can be sold on their benefits to the user, said W. B. Scheidt, Oklahoma Gas & Electric Co. Every sale made is a promotional sale, but he cautioned against cutting prices for promotional purposes because it cuts dealers out of their profit and they will not become allies in sales work unless they can make a profit. To do the sales job, Scheidt urged the recruiting of utility employees, dealers, distributors, builders, architects and engineers.

Since April 1945, 42 heat pump installations have been made on the Union Electric Co system, S. S. Sansbury told the conference. Of these, 20 were residential jobs, and 22 were commercial installations. In all, there were 68 heat pump units.

One installation was made to heat space being added and after experience with the heat pump the customer requested cost figures on replacing heating facilities in the other part of the building.

Roy K. Bear, Kansas Gas & Electric Co, described a plan for having all sales people call on customers and talk heat pump. The company has a plan to help employees buy them.

D. W. Runquist, St. Joseph Light & Power Co, reported that they are making studies to determine the cost of operating with present fuels vs electric heating costs without any special measure, such as insulation. Runquist described a 10-unit motel which has reverse cycle units for heating and cooling.

The advantage of electric heat is the ability to have heat where you want it, when you want it, and in the desired quantity, C. W. Wertz, General Electric Co, told the conference. He described a complete line of industrial heating equipment.

W. B. SCHEIDT of Oklahoma Gas & Electric Co holds the attention of E. P. Hennek, MVEA president; and of S. S. Sansbury of Union Electric Co of Missouri

Figures Fight Diesel Foes

B. J. George and H. M. Henry, Kansas City Power & Light Co, described a comprehensive study of diesel engine operating costs that they have used to combat diesel engine competition. The figures were obtained from Wisconsin Public Service Commission records and from the Federal Power Commission. Rates are OK they concluded, but salesmanship must be applied.

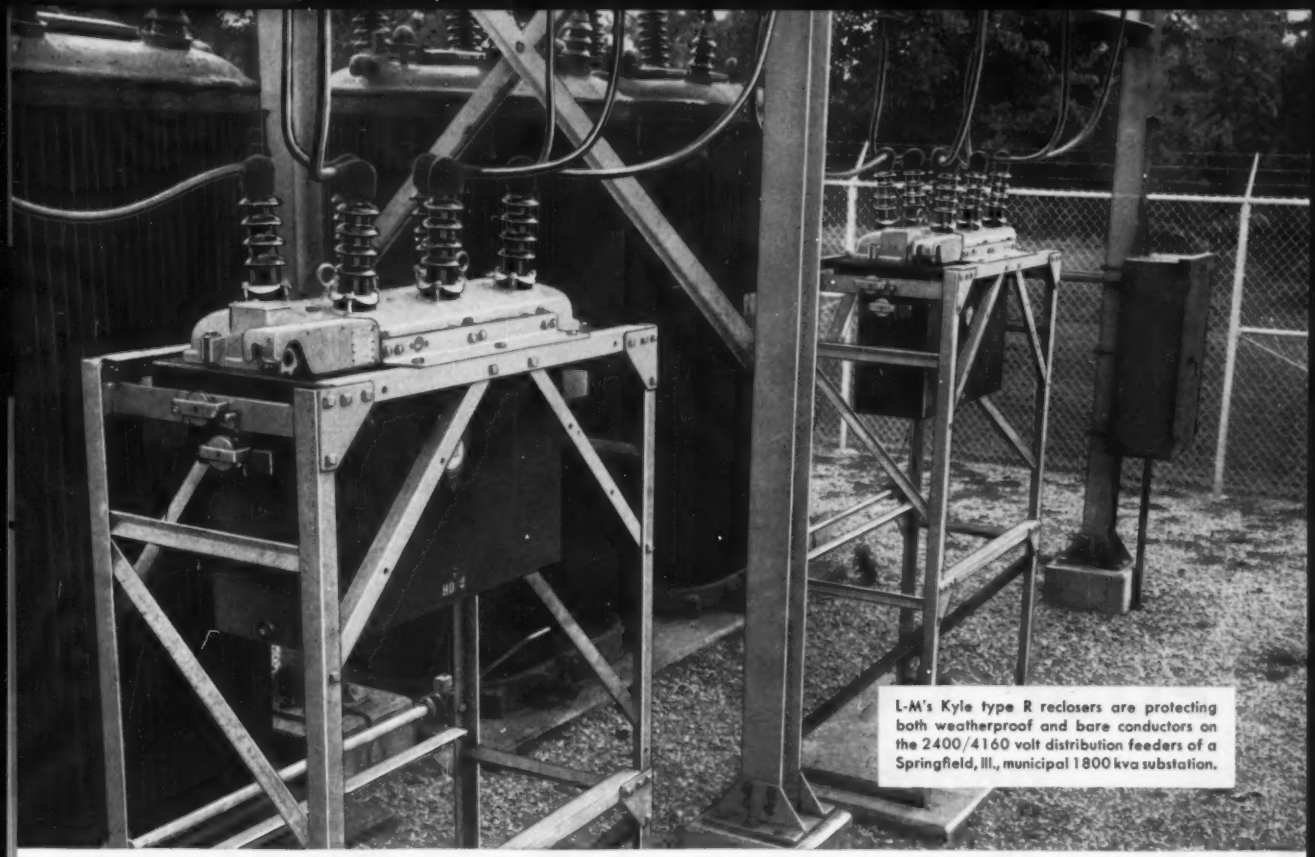
Plant expansion and modernization offer vast opportunities to power salesmen, said Frank Griesinger, Lincoln Electric Co. He urged power salesmen to familiarize themselves with the new depreciation rules that make more cash available for modernization.

Sale May Take Years

Help customers solve their difficult problems if you want to sell lighting, said F. P. O'Connor, St. Joseph Light & Power. He said that his organization had worked with customers sometimes for years before they could get to them and make a sale.

T. C. Sargent, Sylvania Electric Products, Inc, predicted a glowing future for mercury vapor lighting. Color improved lamps, he said, will soon be available with higher lumen output, with significant increases in light output, and with a greater variety of arrangements. He said that soon it will be possible to light school rooms with mercury vapor lights and that in less than ten years half of all street lighting will come from discharge sources.

Utility sales people can help food service operators get a better product at lower cost by selling them electric cooking, O. W. Amador, Iowa Electric Light & Power Co, told the group.



L-M's Kyle type R reclosers are protecting both weatherproof and bare conductors on the 2400/4160 volt distribution feeders of a Springfield, Ill., municipal 1800 kva substation.

Improve Service Continuity . . .

High-Speed Kyle Type R Reclosers Reduce Conductor Burn-Down

by **FRANK McSTAY**
Product Manager
Kyle Products
Line Material Company

The operating speeds of conventional circuit breakers in many cases do not interrupt transient faults fast enough to prevent burn-down of weather-proof conductors or loss of mechanical strength of bare conductors. For this reason, Line Material Company engineers have designed fault-protective devices with extremely fast opening characteristics that will *minimize permanent system faults* resulting from transient or non-persistent causes.

Reduce Damage Caused By Transient Faults

L-M Kyle reclosers are completely automatic and self-contained. They provide high-speed circuit clearing (2-cycle maximum). Up to 90% of transient or non-persistent faults can be cleared by Kyle reclosers with no significant damage to the system or interruption of service continuity.

Ratings from 25 to 400 Amps.

The Kyle type R heavy-duty three-phase oil circuit recloser, shown above, is designed to replace breakers in substations with up to 100,000 kva fault capacity. They are available in normal load ratings from 25 to 400 amperes, with symmetrical RMS interrupting rating up to 6000 amperes at 4.8 kv and below and 4000 amperes up to 14.4 kv.

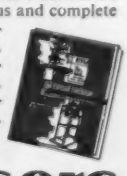
Almost any supplementary relaying scheme is adaptable to the type R recloser for substation application. Units are available with ground tripping, shunt tripping, shunt lockout, and auxiliary switches for remote control indication or low-voltage control switching.

Kyle Type R 3-Phase Reclosers available in normal load ratings FROM 25 TO 400 AMPERES

Ratings Amps.	Min. Trip Amps.	Inter. Ratings RMS Amperes 4.8 kv	14.4 kv
25	50	1500	1500
35	70	2100	2100
50	100	3000	3000
70	140	4200	4000
100	200	6000	4000
140	280	6000	4000
160	320	6000	4000
185	370	6000	4000
225	450	6000	4000
280	560	6000	4000
400	800	6000	4000

Get the Whole Story On L-M's Kyle Reclosers and Sectionalizers

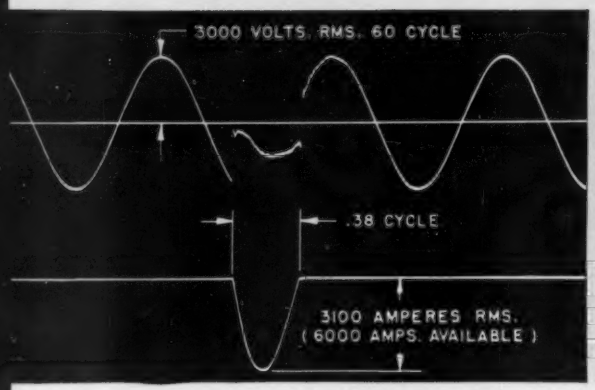
Ask your L-M Field Engineer for information and bulletins on Kyle apparatus and complete coordination—single and three-phase—from substation to load. Or write Line Material Company, Milwaukee 1, Wisconsin. In Canada: Canadian Line Materials, Ltd., Toronto, Ontario.

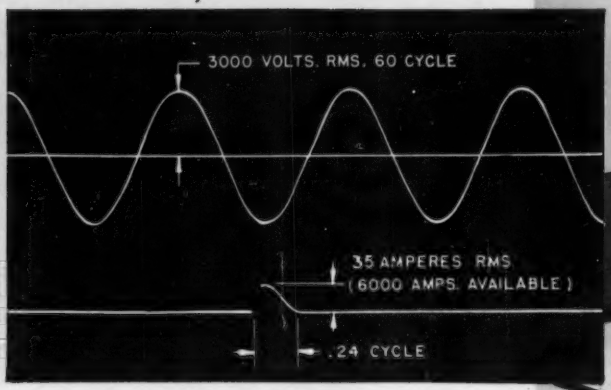


248

LINE MATERIAL Kyle® Reclosers

A McGRAW ELECTRIC COMPANY DIVISION





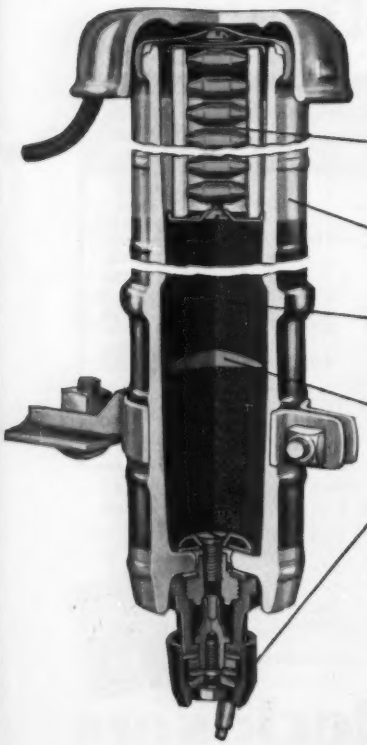
3 KV EXPULSION ARRESTER **3 KV VALVE ARRESTER**

The oscillograms show the operation of typical expulsion and valve arresters handling a lightning discharge with 6000 amperes fault current available. The expulsion arrester, left, draws 3100 amperes follow current; the valve arrester, right, draws only 35 amperes. If expulsion arresters are used, all sectionalizing fuses must be heavy enough to handle 3100 amperes for at least one-half cycle. However, if valve arresters are used, much smaller fuses can be installed, and coordination poses no problem.

FUSE COORDINATION

...another reason why

Valve Arresters Are Better



Features of L-M's Valve Arrester

1. The ladder spark gap is designed to provide a perfect balance between 60-cycle sparkover and impulse sparkover.
2. The Pyrex glass housing permits visual inspection to detect mechanical or electrical damage.
3. "Granulon," the valve material, is able to withstand severe heating which accompanies heavy strokes of lightning.
4. Lens-shaped electrodes in the element compensate for "skin effect," assuring uniform distribution of surge current throughout the valve element.
5. L-M's exclusive "Isolator" gives positive assurance against grounding feeders by instantly disconnecting the ground lead from the arrester if the arrester should ever become damaged.

FOUR PRINCIPAL REASONS

for recommending valve over expulsion type arresters

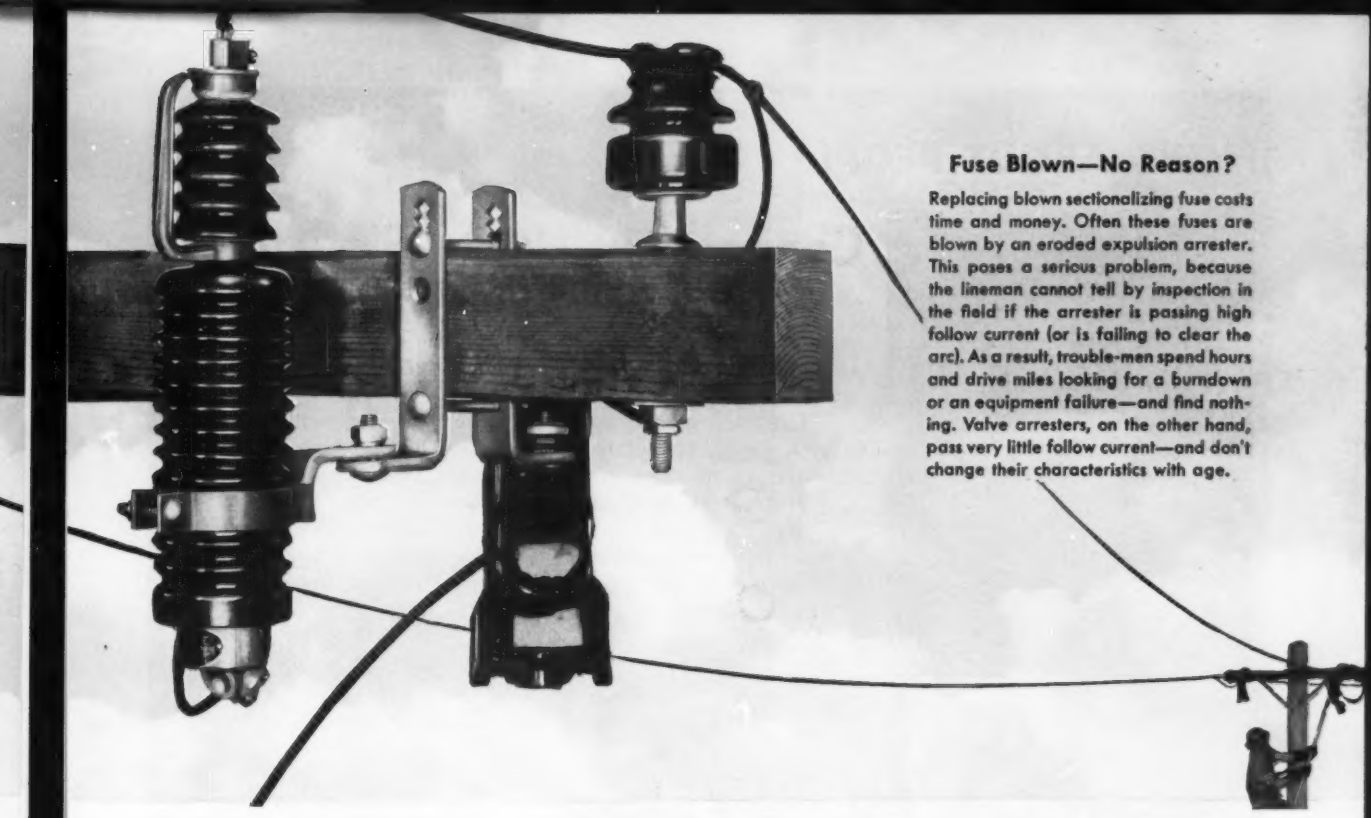
1. Better Protective Characteristics—The valve arrester sparks over more quickly and at lower voltages on lightning surges. Transformer end turns are not stressed by a complete voltage collapse following sparkover. Although the expulsion arrester provides a satisfactory level of protection for most transformers, a higher degree of protection is available through the proper application of valve arresters.

2. Unlimited 60-Cycle Capacity—The application of the valve arrester is not limited by the available short-circuit current. The expulsion arrester, operating on a pressure principle, has a definite top limit and may have a bottom short-circuit current rating. (Too much current causes it to explode; too little fails to expel the arc.)

3. No Fuse Coordination Problems—The valve arrester will pass relatively small values of 60-cycle follow current, regardless of system capacity. Expulsion arresters can pass high follow current which may cause unnecessary operations of sectionalizing devices.

4. Longer Life—The valve arrester is electrically and mechanically unaffected in handling lightning discharges usually encountered in service. Its life is relatively unlimited. The expulsion arrester ages and changes its characteristics because atmospheric conditions and erosion due to operation affect the fibre.

LM® LINE



Fuse Blown—No Reason?

Replacing blown sectionalizing fuse costs time and money. Often these fuses are blown by an eroded expulsion arrester. This poses a serious problem, because the lineman cannot tell by inspection in the field if the arrester is passing high follow current (or is failing to clear the arc). As a result, trouble-men spend hours and drive miles looking for a burndown or an equipment failure—and find nothing. Valve arresters, on the other hand, pass very little follow current—and don't change their characteristics with age.

Than Expulsion Arresters

by **H. V. DRYER**
Product Section Engineer
Protective Equipment
Line Material Company

Utility companies are frequently baffled by the extensive number of fuse outages following a lightning storm. Links are replaced—but still nobody knows why they blew.

When you compare the operations of valve and expulsion arresters, you may see why so many fuses blow on lines with expulsion arresters, and why, although we make *both* types, we at L-M say that *valve arresters are better than expulsion arresters*. The oscillograms at the left above show typical examples of power follow current through a valve and an expulsion arrester, with 6000 amperes fault current available. The valve arrester draws 35 amperes. The expulsion arrester draws 3100 amperes.

Expulsion Arresters

Therefore with this expulsion arrester, all sectionalizing fuse links must be able to handle 3100 amperes for at least half a cycle. This would require at least a 100 ampere or larger "K" link—which is impractical in many cases. Certainly such fusing gives reduced short-circuit protection and greatly increases the problem of fuse coordination.

The problem is further complicated when, after a few operations, the fibre expulsion tube erodes, and the magnitude of power follow current increases. This operation could eventually cause sectionalizing fuses to blow every time the expulsion arrester operates. This poses a serious problem because the lineman cannot tell by inspection if an expulsion arrester has passed high follow current or has failed to interrupt.

Valve Arresters

Fuse coordination is no problem with valve arresters. They pass only relatively small values of follow current, regardless of system capacity. This is true for the life of the arrester—because of the unchanging characteristics of the valve element. In the rare case of complete failure of a valve arrester, L-M provides further insurance in the form of the "Isolator," which instantly disconnects the ground so that the arrester cannot lock out feeders.

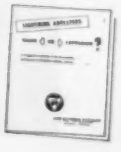
Then Why an Expulsion Arrester?

With all this evidence in favor of valve arresters, you may well ask: "Why did anybody ever make an expulsion arrester in the first place?" The expulsion arrester was created many years ago to satisfy the demands of some operators for an arrester that did not require moisture sealing. Inadequate moisture sealing of early valve arresters was the cause of many failures. Sealing has been perfected and is no longer a problem, as many operators know.

Get Complete Information

Extensive field experience has proven the superiority of the modern valve arrester. Many companies have always used valve arresters, and many others are changing to valve arresters.

Details of some of the extensive evidence in favor of valve over expulsion arresters are given in a new booklet, "Valve Versus Expulsion Arresters." Whichever type you use, we believe you'll be interested in this report. Ask your L-M Field Engineer for a copy, or write Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).



MATERIAL Lightning Arresters

Connecticut Utility Elevates 3

Recent staff promotions by Connecticut Power Co, Hartford, include advancements of H. Warren Lawrence to vice president, Charles Bolton to financial vice president and Russell M. Lay to secretary and treasurer.

Lawrence, general manager for the past year, continues in that post. He had previously served as general superintendent of electric operations, manager of the Farmington Division, and assistant to the manager of the Middletown Division.

Bolton has been a vice president of the company for the past four years and secretary and treasurer since 1946. He is succeeded in the latter post by Lay, assistant secretary and assistant treasurer of Connecticut Power since 1951.

H. W. LAWRENCE

Myers Gets Engineer's Post

Tampa Electric Co has appointed Carl F. Myers to assume the duties of general engineer of the company. Formerly with Ebasco International Corp, Myers comes to the Florida utility with more than 25 years experience in the operating utility field.

After receiving a master of science degree from Massachusetts Institute of Technology he joined Puget Sound Power & Light Co as junior engineer.

His association with the Ebasco organization began in 1949 when he was named assistant sponsor engineer for American & Foreign Power Co properties in Brazil. He later was appointed chief transmission and distribution engineer and head of special projects.

C. F. MYERS

Celler Appointed Sales VP

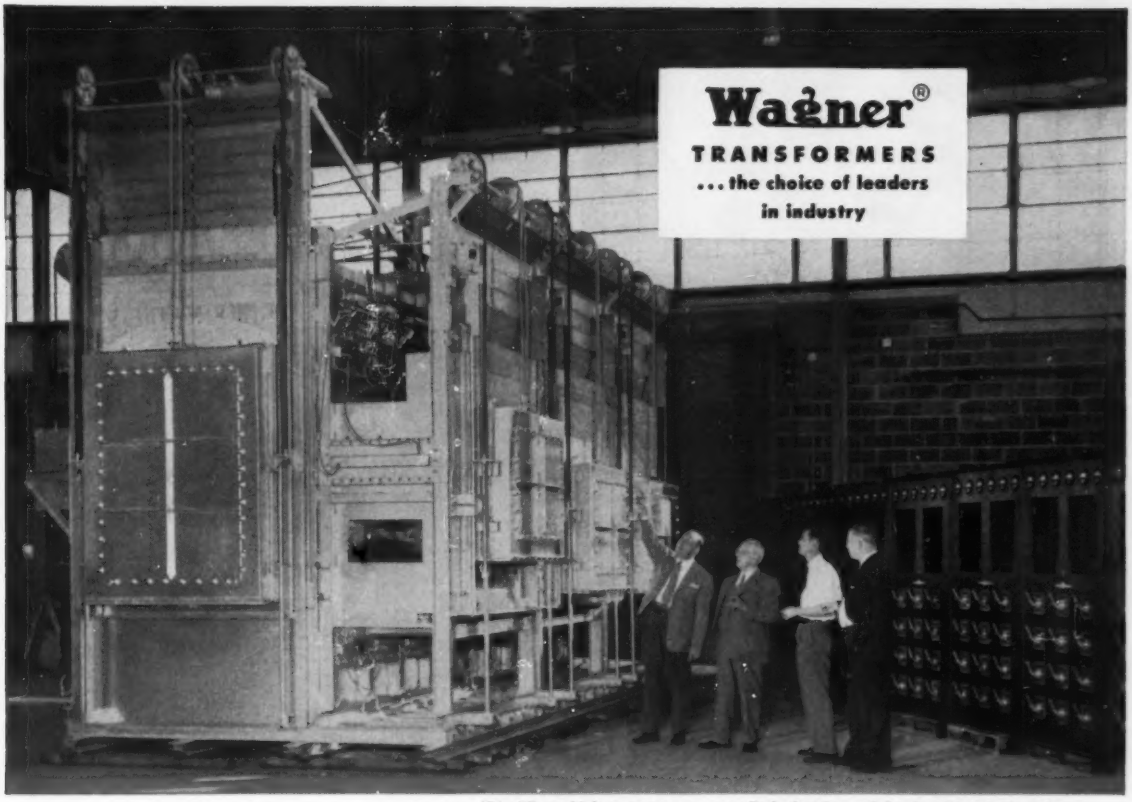
Election of Frederic A. Celler as vice president in charge of sales has been announced by the Brewer-Titchener Corp, New York.

The new vice president joined the firm two years ago as general sales manager. Prior to this he served as an independent business and manufacturing consultant for a number of years. During this period he was retained by S. Stroock & Co to aid in manufacturing, sales, and plant modernization.

Celler is a former executive vice president and general manager of the Puerto Rico plants of Textron, Inc, and also served as a special consultant for the Marshall Plan in Washington, D. C., and in Europe.

F. A. CELLER

(*More News About People on page* 38)



This 55-ton high-temperature, controlled electric steel forging furnace, built by C. I. Hayes, Inc., gets its power supply through Wagner Dry-Type transformers.

Wagner Dry-Type Transformers supply power for the world's largest electric steel forging furnace

In North Grafton, Massachusetts, the Wyman-Gordon Company has placed in service the largest electric steel heating forging furnace ever built anywhere. It has a capacity of 10 tons of steel billets.

The plant, largest single unit in the USAF heavy press program, makes plane components of unprecedented strength, lightness and dimension on 50,000-ton, 35,000-ton and other hydraulic closed die forging presses.

Operating temperatures as high as 2400 degrees Fahrenheit may be maintained with a connected load of 600 kilowatts, supplied to the furnace through eight Wagner Dry-Type transformers.

Wagner Dry-Type transformers were selected for this job because they supply dependable power right at the load. You can spot them *close* to your loads and save money in terms of shorter runs of copper, reduced line losses, and lower installation expenses.

Wagner dry-type transformers for power distribution are available in single-phase, 1 through 500 kva; and three-phase, 3 through 2000 kva ratings. Write for Bulletin TU-57 or consult the nearest of our 32 branch offices.

Wagner Electric Corporation
6436 Plymouth Ave., St. Louis 14, Mo., U.S.A.

BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

WT56-A

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES • AUTOMOTIVE BRAKE SYSTEMS–AIR AND HYDRAULIC

Martin to Head BDSA Unit

Square D Co's Terry B. Martin, right, has been appointed director of the Electrical Equipment Division, Business and Defense Services Administration, U. S. Department of Commerce. Administering the oath of office to him is BDSA Administrator Charles F. Honeywell, left.

Martin will serve actively as director of the Electrical Equipment Division for about six months, after which he will continue to be available as a trained reservist in the event of any future emergency.

Since 1922 he has been connected with the electric motor control industry, starting with the Industrial Controller Co which in 1929 became a division of Square D.

AIEE Lamme Medal Awarded to Dr Hanna

Winner of the American Institute of Electrical Engineers Lamme Gold Medal for 1955 is Dr Clinton R. Hanna, electromechanical systems specialist, inventor, and associate director of research for Westinghouse Electric Corp.

Hanna was honored for "his fundamental calculations and developments in the field of electrodynamics and . . . for his achievements in the design of generator voltage regulators, automatic rolling mill controls, and tank gun stabilizers."

The Lamme Medal, awarded annually since 1928 to an AIEE member showing "meritorious achievement in development of electrical apparatus or machinery," will be presented to Hanna at AIEE's Summer General Meeting in June.

DR C. R. HANNA

PERSONAL BRIEFS

Retirement of **Kenneth P. Applegate,** president since 1951, has been announced by Hartford Electric Light Co. During his 44 years with the utility he has served as draftsman, power salesman, purchasing agent, vice president, and executive vice president.

Stanley Stokes, a vice president of Union Electric Co of Missouri since 1950, retired recently after almost 44 years with the company. At the time of his retirement he was in charge of Union Electric's participation in the Nuclear Power Group in connection with the development of power from nuclear fission.

Arkansas Power & Light Co has named **George W. Walker** as local manager at Eudora to succeed **Ed H. Harper,** who retires after serving in that post for 25 years.

Southern California Edison Co Pres **Harold Quinton** has been elected to the board of directors of the Kaiser Steel Corp.

Recent promotions in Niagara Mohawk Power Corp's system project engineering department include elevation of **J. Norton Ewart** from chief mechanical engineer to assistant chief system project engineer, and **Raymond P. Moore's** succession to Ewart's former post. **Louis S. Bernstein,** chief design engineer, becomes an engineering consultant and **Harold G. Hunt** replaces Bernstein.

Sylvania Electric Products, Inc, has appointed **Maurice V. Odquist** director of new product sales to work with the company's research laboratories and ten operating divisions in the creation, development, and promotion of new products.

Charles H. Shuff has been named director of licensee-integrated sales of Westinghouse Electric International Co. **J. R. Burns** succeeds him as director of the Electronic and Defense Products Division.

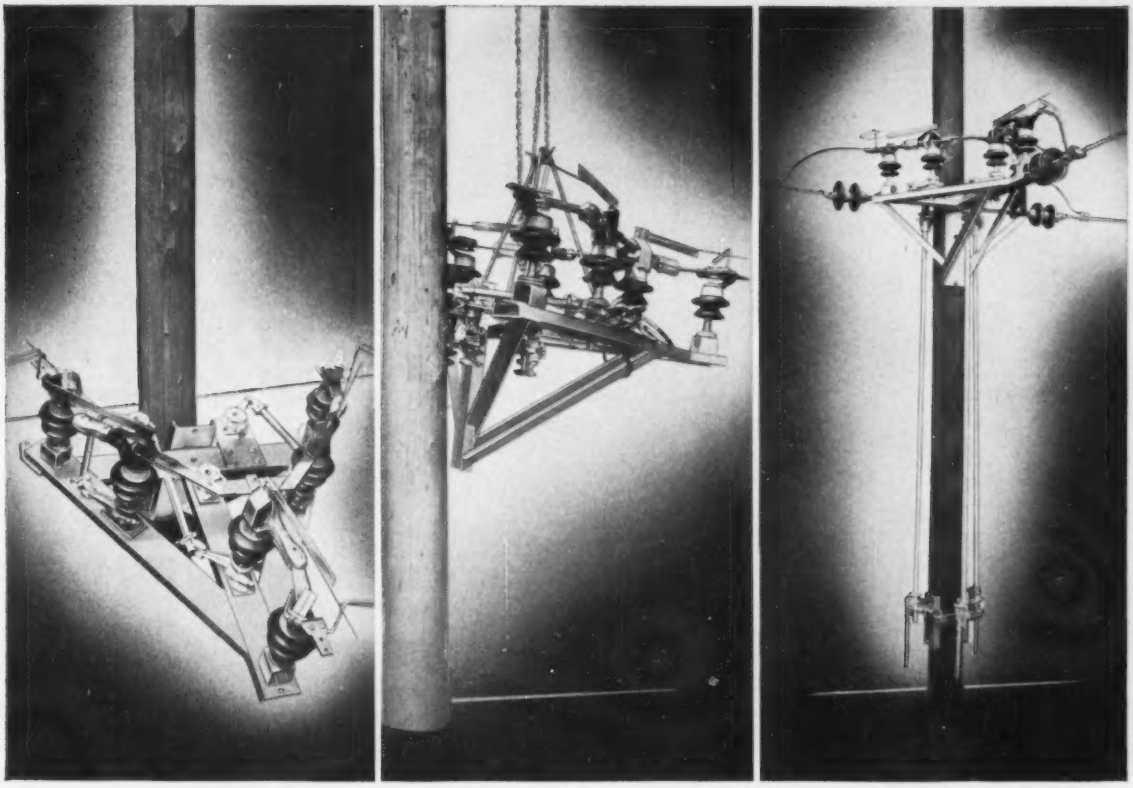
Aluminum Company of America has designated **R. T. Whitzel** general production manager of the company. New general manager of the Smelting Division is **John D. Harper.**

Sprague Electric Co has named **Nathan M. Levinson** to succeed **Jesse M. Allison** as manager of its Industrial Capacitor Division with responsibility for sales of industrial power factor correction capacitors to industry and utilities.

OBITUARY

Stacey T. Williams, 72, former secretary and vice president of Commonwealth Edison Co, Chicago, died recently in his St. Petersburg, Fla. home.

Frank E. Harper, 72, vice president and treasurer of Muller, Harper & Associates, electrical manufacturers representative, Pittsburgh, died recently. He previously was associated with Duquesne Light Co for 20 years.



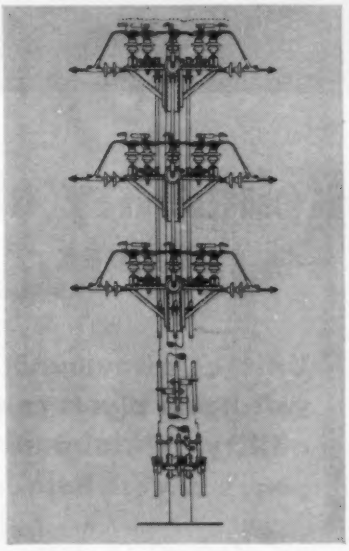
Expansion problems solved quickly with DELTA-STAR Type TH Pole Top Switches

Does time sometimes run short on your expansion projects? Is ground space sometimes at a premium? If you have these or similar problems, you may readily solve them with the installation of Delta-Star Type TH Pole Top Switches.

Installation of Type TH Switches is quick and easy because the switches, bases and frames are mounted as an integral unit. There are no separate units to install. Each switch has a simplified, independent operating mechanism, permitting 3-phase operation from ground level.

Quick-whip arc suppressors eliminate heavy arcing during interruption of line and transformer charging current up to 15 amperes. Standard open gap spacings meet or exceed AIEE and NEMA guarantees.

Type TH Switches can be installed at less than ¾ the cost of conventionally-mounted air switches. It will pay you to check into them soon. Call your nearby Delta-Star representative.



Type TH Pole Top Switches may be obtained for 2-way or 3-way switching, in 400 and 600 ampere ratings, and 7.2 to 69 kv. For complete data, write for Bulletin T-5511.

DELTA-STAR ELECTRIC DIVISION

H. K. PORTER COMPANY, INC.

2437 Fulton Street · Chicago 12, Illinois · District Offices in Principal Cities

Generating capacity of this plant is now 250,000 kw. Output goes into transmission system at 115 kv and 230 kv.

Reliability of Allis-Chalmers Switchgear Is a "Must" at Barry Steam Plant

Unit arrangement of auxiliary switchgear places emphasis on reliability in Alabama Power Company's newest base-load plant

Here's the reason. All station auxiliaries for each generating unit are connected to one bus. This scheme places more than ordinary demands on the Allis-Chalmers auxiliary switchgear in maintaining uninterrupted service because it extends the "unit" principle to the station auxiliary switchgear.

Scheme Saves on Breakers

This arrangement is, of course, economical. Only one incoming breaker is used for each unit. An ingenious scheme of putting a single spare exciter on the tie circuit between two units reduces breaker requirements.

Barry Steam Plant has initial installed capacity of 250,000 kw, with provision for ultimate expansion to 1,000,000 kw.

Starting power for station service auxiliaries is provided by a station service transformer taking power from the 115-kv transmission system. This starting transformer also serves as a backup for the two regular unit station service transformers.

These two transformers are connected to their respective generator buses. They provide power to auxiliaries at 4.16 kv through two lineups of Allis-Chalmers switchgear — each with 22 cubicles.

For Progress in Switchgear

ALLIS-

Transfer Simplified

A manual make-before-break scheme is used to transfer station service load between starting and unit transformers. There is no synchronizing problem, since both starting transformer and generator are connected to same 115-kv bus.

Interlocks are provided to trip out the connected supply breaker when closing the other incoming supply breaker.

Customary interlocks are provided in the switchgear to insure proper sequence of start-up and shut-down of boiler auxiliary motors.

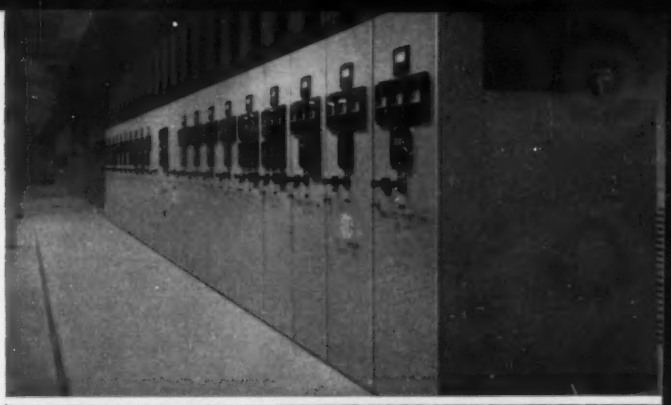
Both overload and short-circuit protection are provided to the switchgear for all feeder circuits.

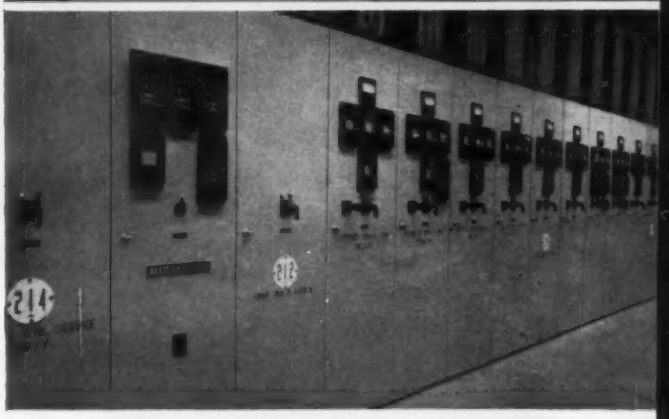
Power is fed to the switchgear near a midpoint in the bus. Essential auxiliaries are duplicated on each side of the supply point.

This means sufficient auxiliaries can be connected to carry about half load in an emergency. And it provides more uniform current distribution in the switchgear.

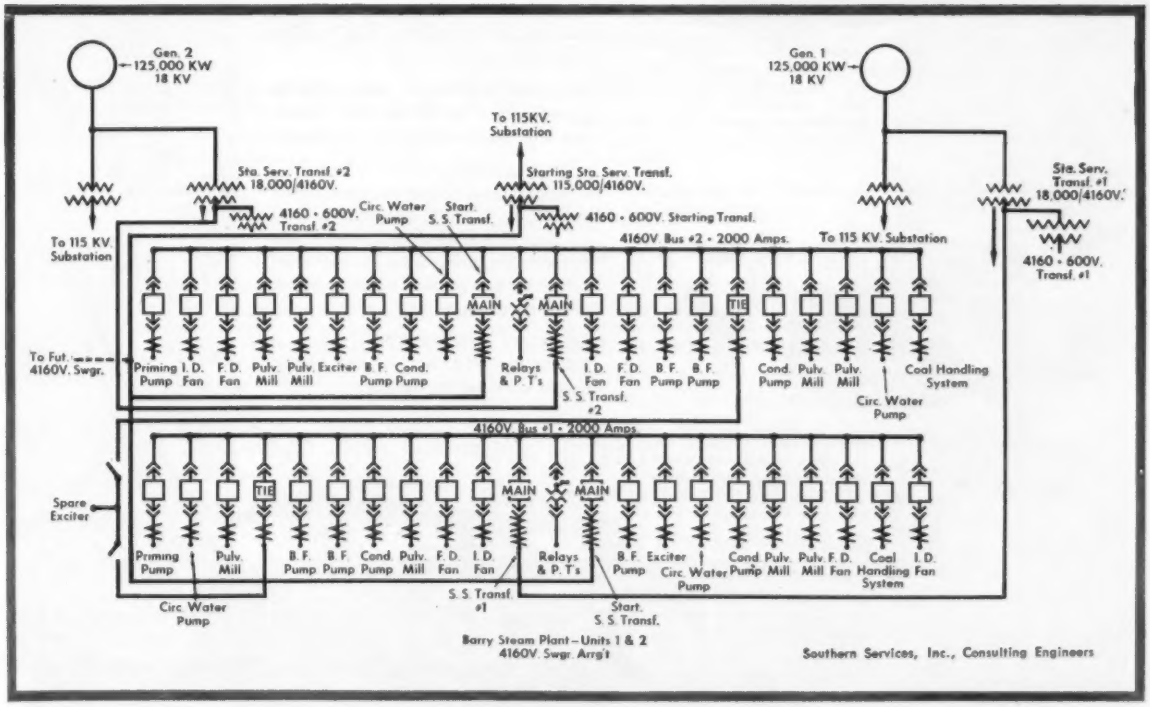
* * *

Allis-Chalmers engineers worked in close cooperation with engineers from Southern Services, Inc. and Alabama Power Company. This is but one of the many auxiliary switchgear installations built by Allis-Chalmers. For more information, call your nearby A-C office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wis.





Two lineups of Allis-Chalmers 4.16-kv switchgear are used; each lineup has 22 cubicles.



CHALMERS A-C ALLIS-CHALMERS

A-4959

POWERS American

Series 450 CONSTRUCTION AND OVERHEAD MAINTENANCE BODY

Does the Work of TWO TRUCKS

Ladder can be revolved 360° at elevations from 30° to 75°. In 23'6", 26'6", and 30'6" mechanical units, or 35' hydraulic model.

Body is 108" long, for installation on dual-rear wheel chassis having cab-to-axle dimension of approximately 60"

Here's a multi-purpose body that does work normally requiring two or more specially-equipped vehicles.

FOR OVERHEAD WORK . . . the body has a Powers-American mechanical or hydraulic Aerial Ladder, in a working height best suited to individual needs.

FOR SERVICE WORK . . . compartments provide space for the orderly storage of a wide assortment of tools and parts.

FOR CONSTRUCTION WORK . . . simplified, easy-to-use derrick handles poles up to 35 ft. in length. A 10,000 lb. underslung winch pays out cable beneath the body floor. A universal swivel sheave permits winch line pull in any direction, without limitation.

COMPLETE DESCRIPTION is given in Bulletin No. 118. A copy, with quotation, is yours for the asking.

Derrick utilizes flexible steel cable instead of conventional center leg. Stows in loading area rack when not in use.

POWERS-AMERICAN DIVISION
McCABE-POWERS
AUTO BODY COMPANY
5900 No. Broadway • St. Louis 15, Missouri

MEETINGS CALENDAR

MARCH

EDISON ELECTRIC INSTITUTE—22nd Annual Sales Conference, Edgewater Beach Hotel, Chicago, March 26-29.

TENNESSEE VALLEY PUBLIC POWER ASSOCIATION—10th Annual Meeting, Farragut Hotel, Knoxville, Tenn., March 30-31.

APRIL

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS—South West District Meeting, Baker Hotel, Dallas, Tex., April 2-4; Special Technical Conference & Exhibit on Magnetic Amplifiers, sponsored jointly with the Institute of Radio Engineers and the Instrument Society of America, Hotel Syracuse, Syracuse, N. Y., April 5-6; 8th Conference on Electrical Engineering in the Rubber and Plastics Industries, Mayflower Hotel, Akron, Ohio, April 9-10; Great Lakes District, Fort Wayne, Ind., April 16-18; Technical Conference, Bradford Hotel, Boston, Mass., April 26-27.

INDIANA ELECTRIC ASSOCIATION—16th Annual Young Men's Utility Conference, Hotel Van Orman, Fort Wayne, Ind., April 4-5.

ELECTRICAL MAINTENANCE ENGINEERS ASSOCIATION—8th National Biennial Electric Industry Show, Shrine Exposition Hall, Los Angeles, Calif., April 5-7.

MARYLAND UTILITIES ASSOCIATION—Annual Business Conference, Lord Baltimore Hotel, Baltimore, Md., April 6.

* **AMERICAN SOCIETY OF MECHANICAL ENGINEERS**—Machine Design Conference, Bancroft Hotel, Worcester, Massachusetts, April 10-11.

MIDWEST RESEARCH INSTITUTE—Synposium for Management on Applications of Analog Computers, Hotel Phillips, Kansas City, Mo., April 10-11.

POINT OF PURCHASE ADVERTISING INSTITUTE—10th Annual Symposium & Exhibit, Hotel Sheraton Astor, N. Y., April 10-12.

NORTHWEST ELECTRIC LIGHT & POWER ASSOCIATION—Engineering & Operation Section, Hotel Vancouver, Vancouver, B. C., April 11-13.

NORTHWEST PUBLIC POWER ASSOCIATION, INC—Annual Membership Meeting, Ridpath Hotel, Spokane, Washington, April 11-13.

SOUTHEASTERN ELECTRIC EXCHANGE—Engineering & Operation Section, Bon Air Hotel, Augusta, Ga., April 12-13.

EDISON ELECTRIC INSTITUTE—Advisory and Executive Committees, Hotel Commodore, New York, N. Y., April 16; National Conference of Electric & Gas Utility Accountants, sponsored jointly with AGA, Hotel Commodore, April 16-18; Industrial Relations Committee, EEI Headquarters, N. Y. C., April 19; Engineering Committees, Edgewater Beach Hotel, Chicago, April 30-May 2.

GREATER NEW YORK SAFETY COUNCIL—26th Annual Safety Convention & Exposition, Hotel Statler, New York City, April 16-20.

ATOMIC INDUSTRIAL FORUM, INC—Atomic Energy Conference, Atlantic-Biltmore Hotel, Atlanta, Ga., & Oak Ridge, Tenn., April 17-18.

BITUMINOUS COAL RESEARCH, INC—Annual Meeting and 3rd Techno-Sales Conference, Deshler Hilton Hotel, Columbus, Ohio, April 18-19.

PACIFIC COAST ELECTRICAL ASSOCIATION—Administrative Services Section Meeting, Huntington-Sheraton Hotel, Pasadena, Calif., April 18-20.

MISSOURI VALLEY ELECTRIC ASSOCIATION—Engineering Conference, Hotel President, Kansas City, Mo., April 18-20.

PENNSYLVANIA ELECTRIC ASSOCIATION—Meter Committee, Roosevelt Hotel, Pittsburgh, Pa., April 19-20.

PROTECTIVE RELAY ENGINEERS—Ninth Annual Conference, Department of Electrical Engineering, Agricultural and Mechanical College of Texas, College Station, April 23-25.

* **VIRGINIA POLYTECHNIC INSTITUTE**—Seventh Annual Engineering Conference, Blacksburg, Va., April 26-28.

ROCKY MOUNTAIN ELECTRICAL LEAGUE—Spring Meeting, Shirley-Savoy Hotel, Denver Colo., April 29-May 2.

MAY

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS—North Eastern District Meeting, Rochester, New York, May 2-4.

EDISON ELECTRIC INSTITUTE—Accident Prevention Committee, Coronado Hotel, St. Louis, Mo., May 2-4; Purchasing & Stores Committee, Sheraton Plaza Hotel, Boston, Mass., May 7-9; Commercial Electric Cooking Conference, Sheraton Hotel, Chicago, Ill., May 8; Transportation Committee Meeting, jointly with AGA, Congress Hotel, Chicago, Ill., May 8-11; Industrial Relations Committee, Willis E. Hughes Memorial, Rochester, N. Y., May 17; Orientation Meeting, jointly with AGA, Headquarters, New York, N. Y., May 21.

NATIONAL FARM ELECTRIFICATION CONFERENCE—LaSalle Hotel, Chicago, Ill., May 3-4.

PENNSYLVANIA ELECTRIC ASSOCIATION—Hydraulic Power Committee, Hotel Warwick, Philadelphia, Pa., May 3-4; Relay and Electrical Equipment Committees, Hotel Roosevelt, Pittsburgh, May 17-18.

NATIONAL ASSOCIATION OF RAILROAD AND UTILITIES COMMISSIONERS—Executive Committee, Leamington Hotel, Minneapolis, Minn., May 4.

AIR-CONDITIONING & REFRIGERATION INSTITUTE—Annual Meeting, The Homestead, Hot Springs, Va., May 7-9.

AMERICAN WELDING SOCIETY—Fourth Welding Show, Memorial Auditorium, Buffalo, N. Y., May 9-11.

* **ATOMIC INDUSTRIAL FORUM, INC**—Hotel Plaza, San Antonio, Texas, May 10-11.

NORTHWEST PUBLIC POWER ASSOCIATION, INC—Engineering & Operations Section, Cascadian Hotel, Wenatchee, Washington, May 10-11.

PUBLIC UTILITIES ADVERTISING ASSOCIATION—Annual Convention, Philadelphia, Pa., May 10-11.

* **INTERSTATE POWER CLUB**—Hotel Martinique, N. Y. C., May 14.

PACIFIC COAST ELECTRICAL ASSOCIATION—Annual Convention, Las Vegas, Nevada, May 14-16.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS—Design Engineers—Design Engineering Conference, Convention Hall, Philadelphia, Pa., May 14-17.

ILLINOIS INSTITUTE OF TECHNOLOGY—Industrial Nuclear Technology Conference, Museum of Science & Industry, Chicago, Ill. May 15-16.

GREAT LAKES POWER CLUB—Wagon Wheel Hotel, Rockton, Ill., May 17-18.

NEW YORK STATE SOCIETY OF PROFESSIONAL ENGINEERS—30th Engineering Industries Exposition with Annual Convention, Statler Hotel, New York City, May 17-19.

INDUSTRIAL HEATING EQUIPMENT ASSOCIATION, INC.—Spring Meeting, The Homestead, Hot Springs, Va. May 20-23.

NORTHWEST ELECTRIC LIGHT & POWER ASSOCIATION—Business Developments Section, Benjamin Franklin Hotel, Seattle, Wash., May 21-23.

AMERICAN MANAGEMENT ASSOCIATION—General Management Conference, Hotel Roosevelt, New York City, May 23-25.

NATIONAL SOCIETY OF PROFESSIONAL ENGINEERS—Annual Meeting, Ambassador Hotel, Atlantic City, N. J. May 23-26.

CIGRE—16th Annual International Conference, Paris, France, May 30-June 9.

JUNE

EDISON ELECTRIC INSTITUTE—24th Annual Convention, Traymore Hotel, Atlantic City, June 4-6.

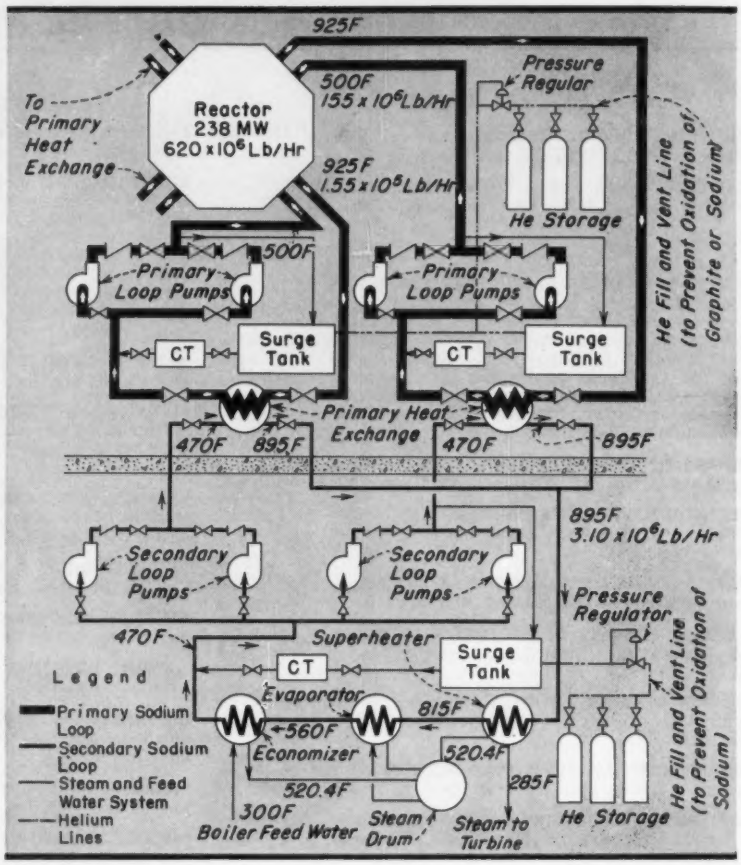
AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS—Summer and Pacific General Meetings, Fairmont Hotel, San Francisco, California, June 25-29.

---

* Additions this week.

Sodium Graphite Pile Shows Promise

Estimated capital cost is $300 per kw; $165 for reactor, $15 for sodium steam generator, and $120 for electrical equipment. Estimated operating cost is 4.0 to 5.2 mills per kwhr; 2.0 to 3.2 mills for fuel, and 2.0 mills for operation and maintenance. Plant has four primary and two secondary sodium coolant loops . . . . . .



CHAUNCEY STARR, Vice President, Atomics International Division of North American Aviation, Inc., Canoga Park, California

One of the promising approaches to economical nuclear power is the liquid-metal cooled, high temperature, non-pressurized, reactor type. Important features of this system are:

1. High coolant temperature—925F at present, 1200F projected—is possible without requiring pressurization of reactor heat extraction system.
2. Reactor can be adapted to a variety of fuel elements and operating conditions.
3. No chemical incompatibilities in the fuel element, coolant, and structure.
4. Absence of releasable potential energy from pressurization or chemical reactions increases inherent safety.

These features are incorporated in the 75-Mw nuclear power-plant proposed by the Consumers Public Power District of Columbus, Neb., under the Atomic Energy Commission's Power Power Demonstration Program. Estimated cost of the plant is $22.5 million.

The proposed 75Mw plant consists of a reactor core cooled by a primary sodium loop, intermediate heat exchangers, secondary sodium coolant loop, steam generators, turbogenerators, condensers, transformers, switchgear, and auxiliary equipment.

Cooled by Sodium

Reactor core is contained in a large diameter steel tank located below ground and cooled by liquid sodium. Sodium coolant is separated into four independent loops and flows from the reactor by means of radial discharge pipes to four intermediate sodium-to-sodium heat exchangers. Loops are contained in individually shielded vaults located in four quadrants around the reactor tank and below ground level. The four individually shielded quadrants permit maintenance on any one of the four loops without complete shutdown of the plant.

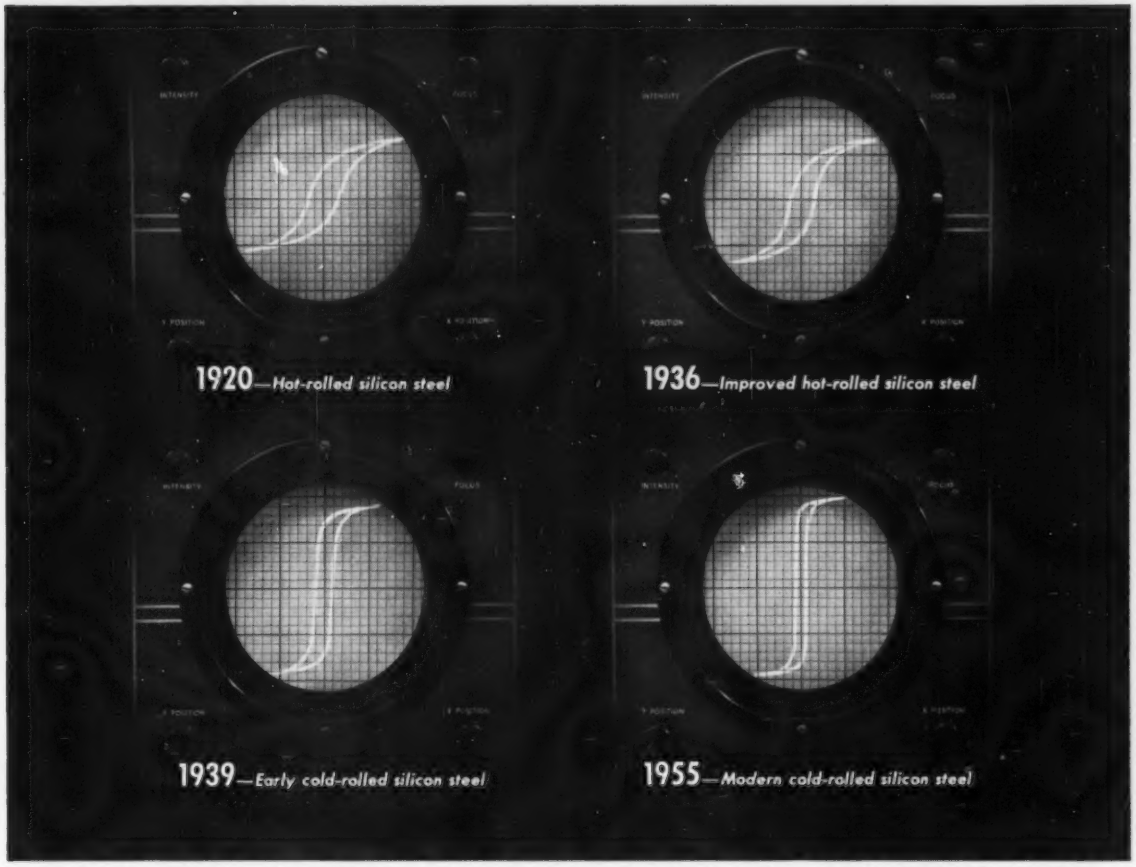
Secondary, non-radioactive, sodium from each intermediate heat exchanger is pumped above ground to the steam generators. Steam generators are separated into two buildings located on either side of the main reactor building and are each fed by the secondary sodium from the two intermediate heat exchangers nearest that side of the building.

Reactor core consists of an array of closely packed, canned, hexagonal graphite cells contained within a large steel tank. The tank is surrounded by a thermal shield insulation. Because the reactor is located entirely below ground level, the concrete foundation provides adequate biological shielding. Top shield is composed of several feet of heavy concrete and could be removed should major repairs to the core be required.

Reactor has been designed to produce a thermal power of 250 Mw with maximum uranium temperature limited to 1200F. Sodium inlet temperature to reactor is 500F. Number of fuel channels and velocity of coolant through the core were chosen

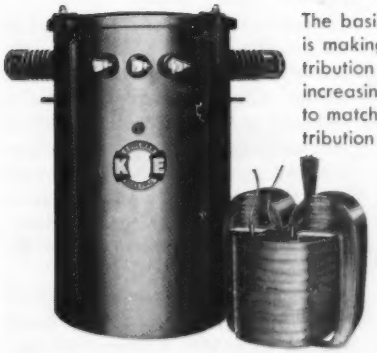
(*Continued on page* 46)

Adapted from paper presented by the author at International Conference on Peaceful Uses of Atomic Energy, Aug 8-20, 1955 held at Geneva, Switzerland



The flux-current loops shown above illustrate the continuous improvement of core steel quality. Developed prior to cold-rolled grain-oriented silicon steel, the ideally constructed KUHLMAN Bent Iron Core has been able to take full advantage of every improvement in core steel.

The KUHLMAN Idea That Is *STILL* Making Transformer History



Transformer research was in its infancy in 1929—the year KUHLMAN pioneered the revolutionary Bent Iron Core. Considered the greatest single achievement in modern distribution transformer development, the KUHLMAN core is still making history.

The basic KUHLMAN bent iron core design is making possible today's lightweight distribution transformers . . . and today's increasing pole mounted transformer KVA to match the load increase of growing distribution systems.

KUHLMAN, with a record of more than 60 years of research and product development, has made many lasting contributions to the electrical industry. Today, with research facilities never dreamed of in 1929, KUHLMAN continues to give you and your customers the benefits of advanced transformer design.

We invite you to ask your KUHLMAN representative, or write direct, for KUHLMAN KURRENTS, Vol. 31, No. 2, which contains the exciting story of modern KUHLMAN research.

KUHLMAN
ELECTRIC COMPANY

BAY CITY, MICHIGAN • CRYSTAL SPRINGS, MISSISSIPPI • SALINAS, CALIFORNIA

PERFORMANCE AND DESIGN DATA

A. REACTOR

1. Reactor Type	Thermal heterogeneous
2. Reactor Operating Data	
Nominal rated output, Mw (thermal)	250
Average thermal flux in fuel, neutrons/sec-cm²	2.5×10^{13}
3. Materials	
Fuel	Uranium metal, slightly enriched in U^{235}
Moderator and reflector	Graphite
Fuel element cladding	Type 304 stainless steel
Coolant tube	Zirconium
Primary & Secondary coolant	Sodium
4. Core Nuclear Data	
Core diameters (including reflector)	17.3 ft
Core height (including reflector)	14.0 ft
Core composition, per cent by volume	
Graphite	87.05
Sodium	6.72
Stainless steel	0.43
Uranium	3.57
Zirconium	1.81
NaK	0.32
Void (gas)	0.10
U^{235} content (initial loading), kg	443
5. Fuel Element Data	
Type of fuel element	19-rod cluster
Number of elements in reactor	215
Fuel slug material	Uranium
Diameter of uranium slugs, in.	0.455
Length of fuel slug, in.	12.0
Initial fraction U^{235} in fuel, at %	1.80
Weight of uranium in reactor, kg	24,600
6. Control and Safety Rod Data	
Number of control rods	10
Type of rods	Boron steel

B. COOLING SYSTEM DATA

1. Reactor	
Coolant	Sodium
Temperature in deg F	500
Maximum coolant velocity, ft/sec	9
Flow rate, lbs/hr	6.5×10^6
Maximum heat flux, Btu/hr-ft²	350,000
Maximum fuel temperature, deg F	1,200
2. Primary Loops	
Number of parallel circuits	4
Inlet temperature to primary heat exchanger, deg F	925
Outlet temperature from primary heat exchanger, deg F	500
Flow rate in each circuit, lbs/hr	1.625×10^6
Number of pumps in each circuit	2
3. Secondary Loops	
Number of parallel circuits	2
Inlet temperature to superheater, deg F	895
Outlet temperature from economizer, deg F	470
Flow rate in each circuit, lbs/hr	3.25×10^6
Number of pumps in each circuit	4

so that a mean bulk outlet temperature of at least 925 F would result.

Fuel elements consist of clusters of 19 rods. Each rod is made up of ten slightly enriched (1.8%) uranium fuel slugs contained in a stainless steel jacket.

Rods are joined to a common hanger rod by which they are suspended in the coolant channels. On each assembly there is an orifice plate to throttle flow of coolant to each fuel cluster. Size of orifice plate is determined by location of element in reactor so that bulk coolant outlet temperature may be maximized.

Moderator elements are graphite columns contained within sealed zirconium cans. There are small gaps between zirconium and graphite to allow for thermal expansion and clearance for assembly.

Core tank is 17.5 ft inside diameter wtih 2-in. walls made from stainless steel plate. Near the bottom of the tank is a core support plate which locates and supports moderator and reflector elements. Beneath this plate is a second plate or tube sheet, forming two plenum chambers, one between the two plates and one between the lower plate and the bottom of core tank. Coolant channels extend through both plates so that main sodium flow is from lower plenum chamber up through coolant tubes.

Primary sodium coolant removes heat from fuel elements, moderator and reflector elements, and thermal shield. This useful heat represents more than 98% of the total energy produced. Heat generated in the neutron shield and losses through the thermal insulation are removed by a low temperature cooling system.

Sodium cooling system is divided into primary and secondary sections so that radioactive primary coolant is contained in a small volume and is separated physically from steam generator units. There are four parallel primary loops.

Because of radioactivity induced in the sodium, that portion of the primary sodium system not inside the reactor must be surrounded by a gamma shield. Sodium-to-sodium heat exchangers, primary system piping, and pumps associated with each loop are located in a vault adjacent to reactor and below ground level. There are four such vaults, one for each loop.

Secondary non-radioactive sodium system receives its heat from primary system with 30F temperautre loss. There are two secondary loops with

(*Continued on page* 48)

NEW SERVICE ENTRANCE CABLE FROM KAISER ALUMINUM!

Provides initial material savings over copper. Lower cost combined with advantages in handling and installation means you realize new benefits when you specify Kaiser Aluminum Service Entrance Cable, Type SE—Style U.

Increased service capacity for adequate wiring. Because of its substantially lower cost, aluminum permits you to increase service capacity without increasing costs. As a result, service entrance construction in your adequate wiring program can be accomplished at less expense.

Eliminates bi-metallic connectors at weatherhead. There is no need to join service entrance cable and service drop cable with expensive bi-metallic connectors when you specify aluminum for *both* constructions.

Neoprene covering provides superior protection. Kaiser Aluminum Service Entrance Cable gives you neoprene jacketed construction at no extra cost over the usual braid covered cable. In areas where requirements permit, this cable may be used without conduit attached to the sides of buildings and through walls. In addition, the neoprene jacket can be painted, will not mar siding, and is far neater in appearance than braid covers. Unlike braid, neoprene withstands rough handling without breaking.

Can be used as service drop to eliminate weatherhead. Kaiser Aluminum Service Entrance Cable is light enough to be used as a service drop cable, if desired, to eliminate splices at the weatherhead. Also, where attachments to buildings are low because of house design, this new cable meets National Electric Code requirements for minimum clearance.

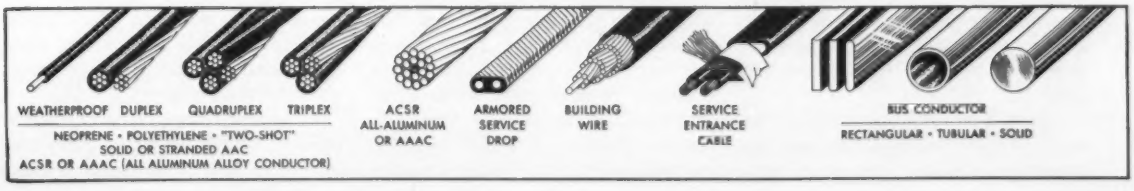
Available in many constructions. New Kaiser Aluminum Service Entrance Cable is available solid and stranded in two- and three-conductor cables. AWG Sizes 10, 8, 6, 4, 2 and 1, with neutral conductor equal to or two sizes smaller than power conductors. These constructions exceed the Underwriter's Laboratory standards for rubber covered wires and cable.

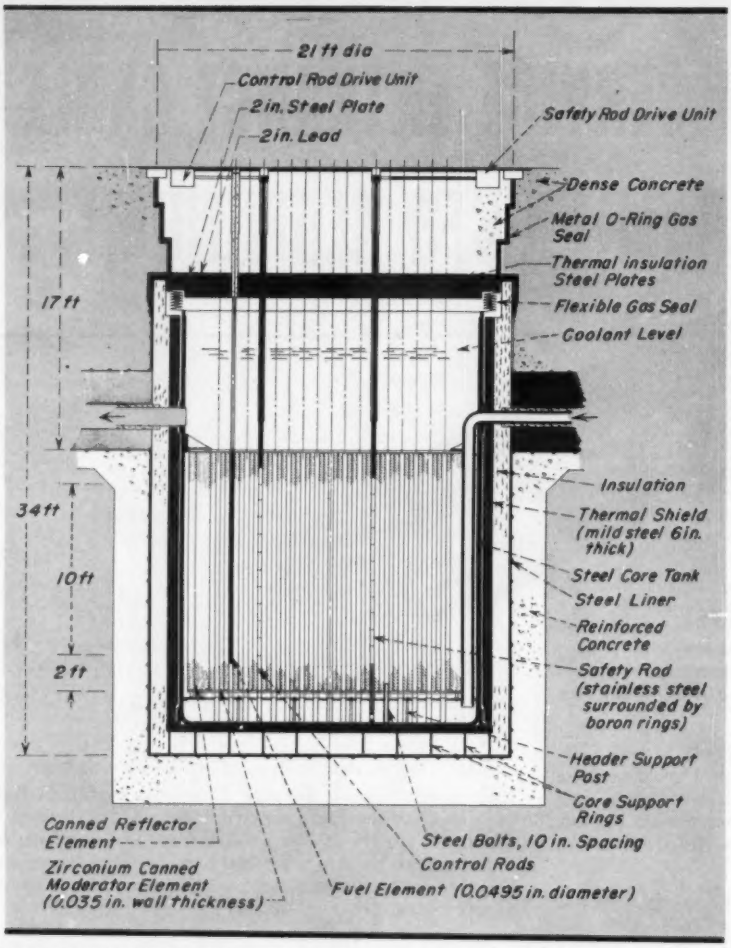
For more information, contact any Kaiser Aluminum sales office or one of our many distributors. Kaiser Aluminum & Chemical Sales, Inc., *General Sales Office,* Palmolive Bldg., Chicago 11, Illinois; *Executive Office,* Kaiser Bldg., Oakland 12, California.

KAISER WIRE®

Kaiser Aluminum

The nation's largest producer of triplex and aluminum weatherproof conductor





COOLANT FLOWS from bottom of reactor vessel up through coolant tubes removing heat from the fuel elements, moderator, reflector, and the thermal shield

four pumps in parallel in each loop. Secondary sodium gives up its heat to steam in the superheaters, evaporators, and economizers.

Fuel handling system replaces, stores, inspects, cleans, and transports new and spent fuel elements. While reactor is shut down, fuel transfer cask is used to transfer new fuel elements to reactor and to remove spent fuel elements from reactor and then transfer them to a cleaning cell. After reactor operation is resumed, cask is used to transfer irradiated elements from cleaning cells to storage cells. Design permits making and breaking gas-tight connections between cask and reactor loading face, new fuel storage cell, or cleaning cells.

Selection of an initial turbine cycle involved a compromise between two competing factors, maximum heat generation from a given reactor and maximum conversion of this heat into electric energy, i.e., maximum thermal efficiency.

Heat removal from a reactor fuel element depends on the temperature drive from center to surface. Because of excellent heat transfer characteristics of sodium, the temperature gradient between the fuel element surface and the sodium coolant is quite small. Therefore, heat removal from the reactor depends primarily upon the difference between the center temperature of each fuel element and average temperature of liquid sodium flowing up and through each fuel channel. Present state of metallurgical development sets an upper limit upon fuel element center temperature. Therefore, an increase in heat generation, at constant sodium velocity, can only be accomplished by lowering the average sodium temperature.

Conversion of thermal power to electrical power decreases with a decrease in average sodium temperature. For a given heat sink, the efficiency of any heat cycle is determined by average temperature of heat addition. Thus, in order to obtain a high thermal efficiency, a fairly high average sodium temperature is required.

Equal Sodium Flow

Heat generation varies radially from a maximum for center fuel elements to a minimum for the peripheral elements because of neutron flux distribution. Equal sodium flow through each channel would result in a low mixed mean sodium outlet temperature because of greater number of outer fuel elements. In this situation only the inner fuel elements are at maximum permissible center temperature. Therefore, sodium flow through each fuel channel is adjusted by throttling such that outer channels have least flow.

Non-reheat regenerative steam cycle appears to be optimum choice at this time. In conventional fuel-fired stations fuel economy can be considerably increased by use of five or more extraction feedwater heaters which raise the temperature of feedwater to about 400F. In a nuclear plant, however, a high feedwater temperature has a detrimental effect. It either lowers maximum possible steam pressure with a consequent loss in cycle efficiency, or it decreases reactor power output. Decrease in reactor power output does not result in any significant reduction in either capital expenditures or operating costs; whereas higher feedwater temperature is obtained only by installation of five or more heaters at a cost of about $50,000 per heater.

Cycle Best Compromise

In this design mean temperature of primary sodium leaving reactor has been limited to 925F and a non-reheat regenerative cycle with 800 psig/825F throttle conditions and a feedwater temperature of 300F has been chosen. Choice of 800 psig/825F represents best compromise between a low cycle heat rate, adequate temperature drives in sodium to water heat exchangers, and permissible moisture in turbine exhaust.

In present reactor design maximum primary sodium temperature has been limited to 950F resulting in a mixed

mean sodium outlet temperature of about 925F. A 30F temperature difference in primary-to-secondary sodium heat exchangers results in a secondary sodium temperature of 895F which, for a 70 degree approach in the hot end of the superheater, permits a steam temperature of 825F.

Capital charges for this plant have been estimated to be about $165 per installed kw of electrical capacity for the reactor portion, $15 for sodium steam generator, and $120 for electrical portion of the plant. These three items total $300 per kw.

Total fuel costs have been estimated to be 2.0 to 3.2 mills per kwhr and the fixed operating and maintenance charge as 2 mills. Thus, total operation charges of nuclear plant contribute 4 to 5.2 mills per kwhr to cost of power.

Power costs given are based on (1) conservative design limitations and (2) cost data extrapolated from experience obtained in construction of the Sodium Reactor Experiment. Thus, these power costs indicate what can be expected from "first generation" sodium-graphite nuclear power plants, based upon the present state of engineering information. Reductions in power costs from sodium graphite plants will come from improvements in three broad areas; namely, (1) design and manufacturing simplification, (2) improved utlization of nuclear fuels, (3) increased plant thermal conversion efficiency. Capital costs used reflect laboratory type fabrication and instrumentation, and the unusually set of rigid specifications.

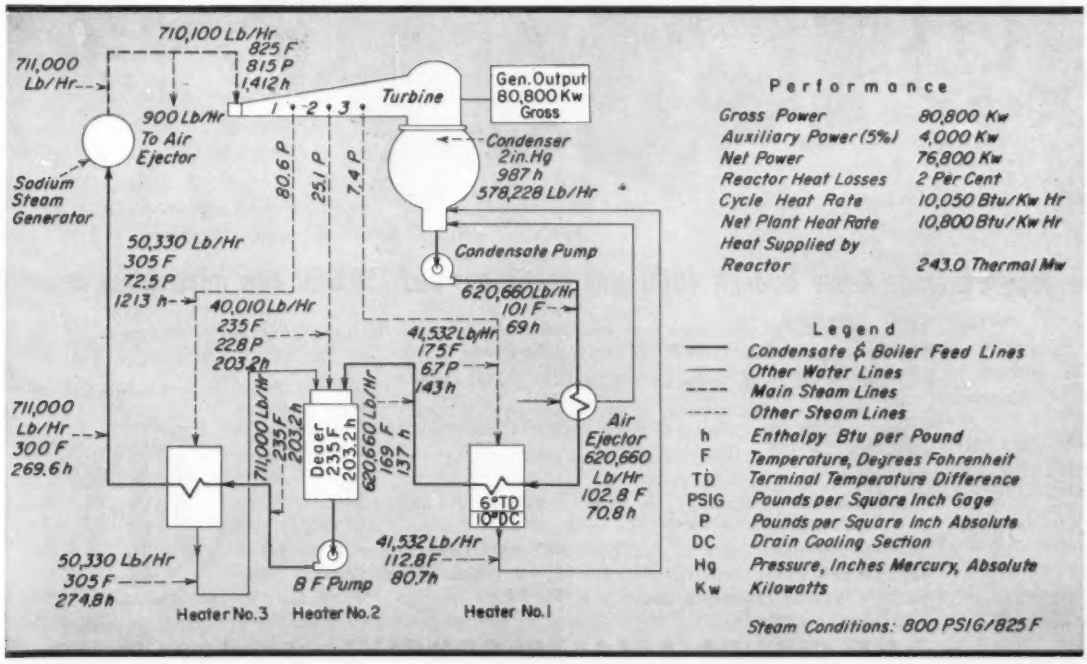
Blanket Can Be Used

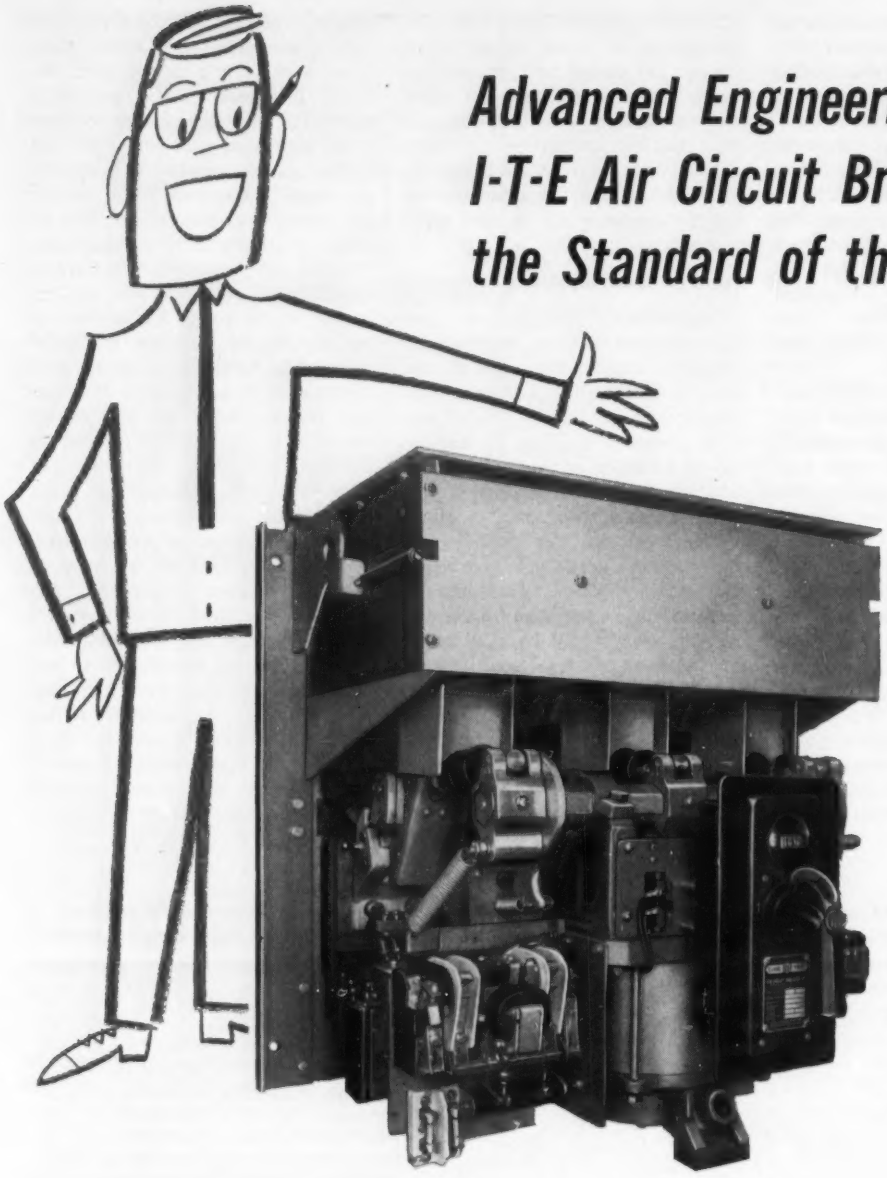
Improvements in nuclear performance may be more quantitatively estimated. Largest single loss of neutrons in this design is leakage neutrons from core. About 10% of neutrons produced are lost by leakage. Use of a blanket of thorium can substantially reduce non-productive leakage loss of neutrons. Blanket with a catching efficiency of 65% would thus yield an external conversion ratio about 0.14. Because of reduced reflector savings from use of a blanket, core diameter would have to be increased about two ft to maintain critically, total conversion ratio would then become 0.95, provided the nuclear performance is actually as good as estimated. There is every reason to believe that a slightly larger reactor with improved core design and utilizing an effective blanket arrangement will yield conversion ratios about unity. Thus, with such a design, after the initial fuel loading, the only feed material to the plant would be thorium.

As mentioned previously, the size of the reactor, number of elements, etc, were determined from nuclear and economic considerations. The reactor is capable of producing considerably more power than the amount required to generate 75 Mw of electricity. If the center temperature of the thorium is increased to 2000F and sodium velocity through the central channel is increased to 25 ft per sec, the capability of the reactor would be nearly 400 Mw thermal, or approximately 125 Mw electrical, with 920F limit retained for maximum sodium temperature.

Present development program is expected to raise the 950F limitation on maximum sodium temperature. Advances in this direction will permit a further increase in thermal power from the reactor described here and also will permit improved steam conditions. In fact, the thorium-base fuel element is uniquely capable of taking advantage of higher sodium temperatures as very high center temperatures in the metal can be sustained.

THREE FEEDWATER HEATERS will be used as shown by preliminary heat balance. Plant will have thermal efficiency of about 33%. Capital cost of plant has been estimated at $300 per kw. Fuel cost will be about 2.0 to 3.2 mills per kwhr





Advanced Engineering Makes I-T-E Air Circuit Breakers the Standard of the Industry

New design extends K line through 4000 amp continuous and 150,000 amp interrupting capacity

Here are some of the extra features that make the new K line of I-T-E circuit breakers the standard of the industry:

- Compact arc chutes designed to provide fast, efficient arc interruption
- Contact structure utilizing silver-alloy, wiping action, sturdy construction and blow-on arrangements to assure superior interrupting ability, and long life
- Dual magnetic overcurrent trip, dual selective overcurrent trip, and other auxiliary devices
- Standardized location of all tripping devices, solenoid relays, auxiliary switches and terminal blocks

For the complete story of I-T-E superiority, contact your local I-T-E representative. Or write for Bulletin 6004B, I-T-E Circuit Breaker Company, 19th and Hamilton Sts., Phila. 30, Pa.

I-T-E

I-T-E CIRCUIT BREAKER COMPANY • Switchgear Division

Making Plans for EEI Personnel Parley

Howard Senyard, (seated center), shows Edison Electric Institute's Industrial Relations subcommittee plans for EEI's Annual Round-Table Personnel Conference. Senyard is chairman of the subcommittee planning the conference to be held at the Drake Hotel on Sept. 17-19 at Chicago.

Theme will be, "Preparing Today for Tomorrow's Problems. The subcommittee has selected these four topics:

1. Preparing Today the Employee for Tomorrow's Problems.
2. Preparing Today the Supervisor for Tomorrow's Problems.
3. Preparing Today the Union for Tomorrow's Problems.
4. Preparing Today the Industrial Relations Department for Tomorrow's Problems.

Other members of the subcommittee shown above (standing l to r) are: Carl E. Parker, Commonwealth Edison Co; John Arnell, Consolidated Edison of New York and chairman of EEI Industrial Relations Committee; Edward J. Brill, Pennsylvania Power & Light Co; (sitting l to r): Frank Osta, Niagara Mohawk Power Corp; Senyard, Louisiana Power & Light Co, and Marvin F. Osterling, Hartford Electric Light Co.

GRDA Strike Ruled Out By Oklahoma Court

Unions have no right to strike against the Grand River Dam Authority and the authority cannot be compelled by a union to enter into a labor contract, Oklahoma Supreme Court ruled recently.

International Brotherhood of Electrical Workers members walked out of the hydro plants of the authority in July 1953 but were ordered to return to their jobs by the district court.

Attorneys of GRDA contended that the "public health, welfare, and safety" of 50,000 persons in cities served by the plants, plus persons living in 38,500 farm homes, would be endangered by the strike.

The court held that the GRDA is a state-owned and operated governmental agency and has "authority to exercise such public functions as are now or may hereafter be prescribed by the legislature."

"Employees of the GRDA are employees of the state of Oklahoma conducting a state function for public purposes and have no right to strike against the state," Justice Floyd Jackson, who wrote the 5-to-1 majority opinion, said.

Florida Power Adopts New Retirement Plan

Florida Power Corp has adopted a new rule regarding retirement of its employees at 65, under which each employee who does not want to retire at that age will have his case considered individually.

"Instead of making it a hard and fast rule that employment must end at age 65," a spokesman for the company said, "the policy in the past has been that one-year extensions of employment might be granted at the discretion of the company."

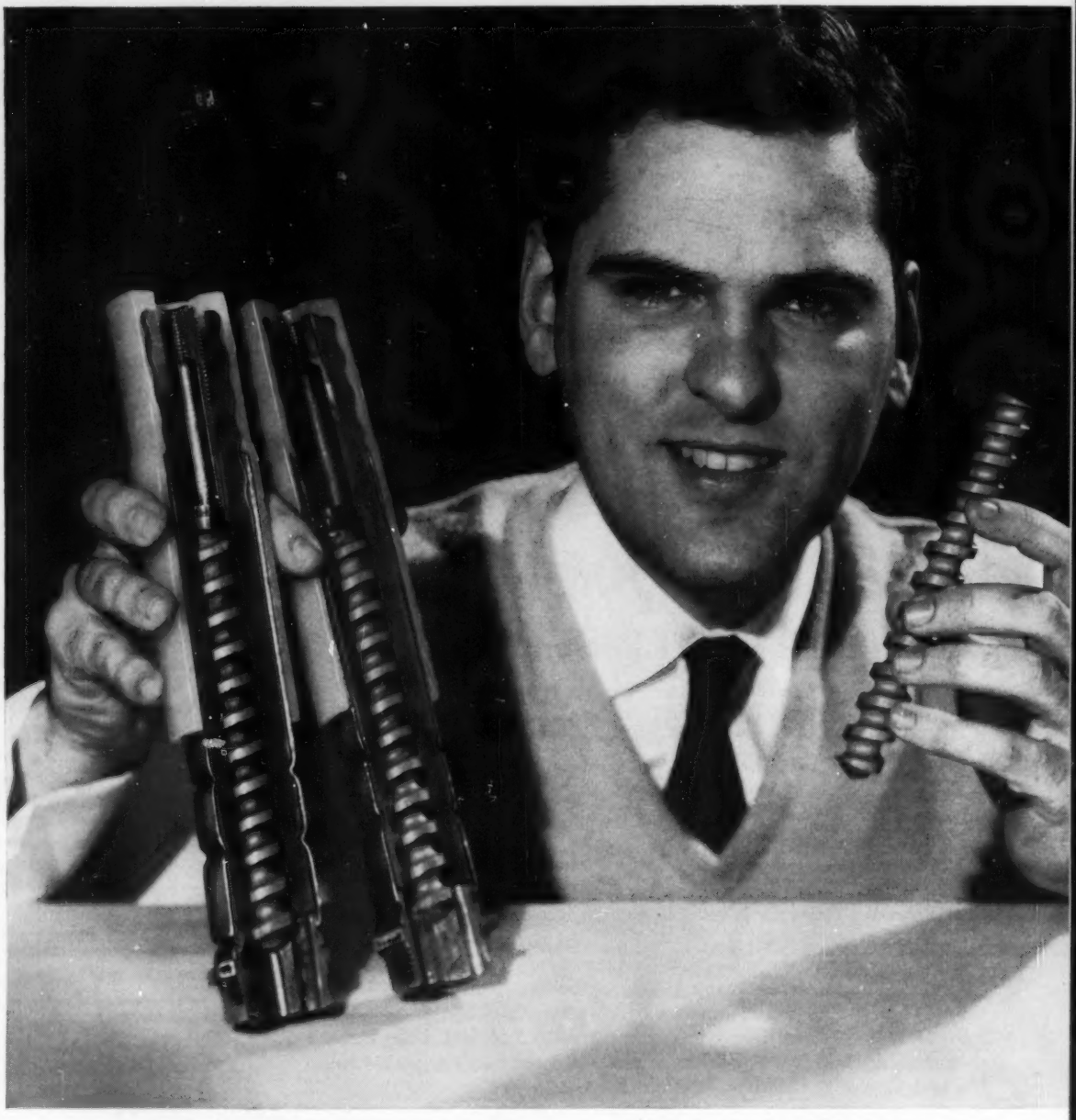
Each employee request for additional employment under the old plan was studied and approved or denied by company's board of directors, depending upon many factors.

Under the new policy, the spokesman said, one-year extensions of employment may still be approved, but the number of such extensions will be limited so that by 1958 no employee may be granted an extension after reaching age 68. Until 1958 a sliding formula is being put into effect to allow a period of adjustment for present employees who have been approved for continuous employment beyond age 65.

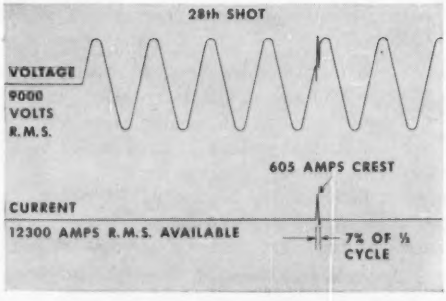
LABOR BRIEFS

A booklet titled "Careers for the Electrical Engineer" has been published by Career Publications. It shows job opportunities for qualified young men by leading national employers. For copy write: Career Publications Inc, 14 West 45th Street, New York 36; price: $1.00.

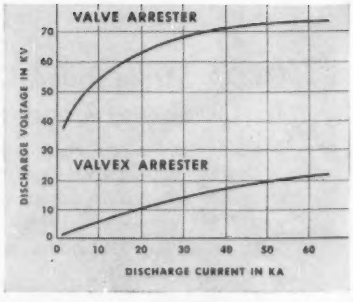
Communications Workers of America has appointed a five-member committee to study the merits of private versus publicly-owned telephone facilities in the U. S. and Canada.



At the 10th and 28th power-follow tests at plant setting of 9000 volts and 12,300-rms amps, tube and spiral of a 9-kv ValvEX arrester showed virtually no wear. Compare with new filler shown on the right.



Duration of current-follow on the 28th test was only .000583 second (7% of ½ cycle); peak current, less than 5% of rms plant setting (12,300 amps for each test).



ValvEX arrester discharge voltage is less than one third that of valve types—resulting in considerably lower winding stresses in the transformer protected.

Apply ValvEX® arresters

to *either* urban or rural locations!

The new Westinghouse De-ion® ValvEX arrester is a top performer both in rural areas where maximum surge currents occur and in urban systems where there are maximum fault currents. Twenty-five million arrester years of service with a failure rate of only 0.026% prove the principle of Westinghouse expulsion arresters. The ValvEX arrester, installed on all new Westinghouse "CSP®" transformers, combines the best features of both valve and expulsion types. This fact gives you the following advantages unmatched by arresters of any other type, design or manufacture:

1. The new spark-over levels, at less than half transformer BIL, are essentially equal in most ratings to valve types, actually better in others. These levels are 40% lower than early Westinghouse expulsion arresters which are still protecting transformers installed 20 years ago.

2. Higher surge-current capacity . . . tested up to 100,000 amps, a clear margin of extra capacity. The ValvEX arrester has an inherently low arc drop; little energy is absorbed. Open construction quickly exhausts gases to air, relieving pressure.

3. Lower discharge voltage on higher surge currents—less than one third of valve types. Prevents dangerous voltages from being impressed on transformer insulation.

4. ValvEX arresters in actual service pass *no* power-follow in *more than half* of all operations; when power-follow current does flow, it is limited to a small fraction of available fault current, its duration to a fraction of a half cycle.

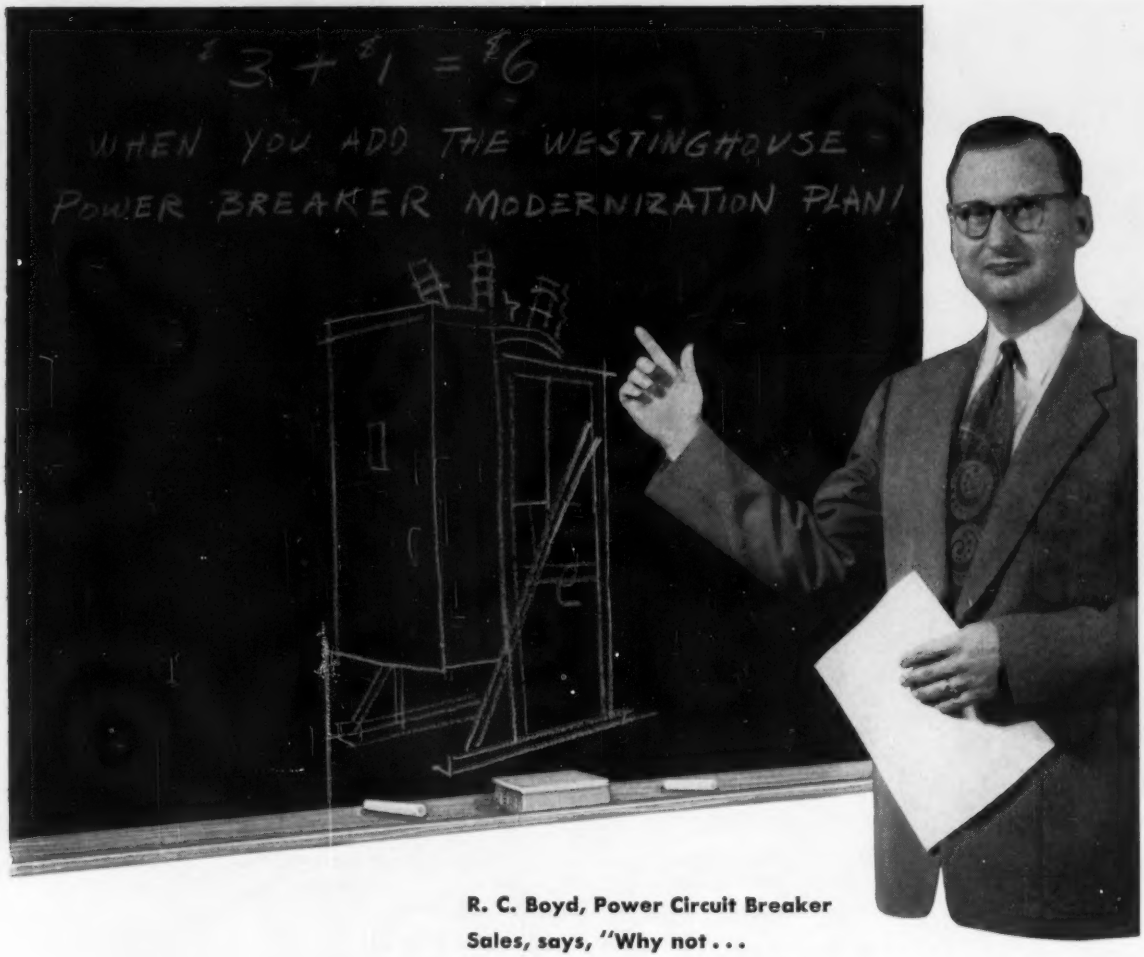
In addition . . . ValvEX arresters are less sensitive to system overvoltages. They provide superior performance on repetitive strokes and on long tail surges . . . performance not possible with energy-absorbing valve arresters.

For more facts, call your Westinghouse sales engineer, or write, Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-70758

ValvEX arresters, installed on all Westinghouse "CSP" transformers, are universally reliable . . . at the substation or at the end of an exposed line.

YOU CAN BE SURE...IF IT'S

Westinghouse



R. C. Boyd, Power Circuit Breaker Sales, says, "Why not . . .

uprate breakers at 1/3 new equipment cost"

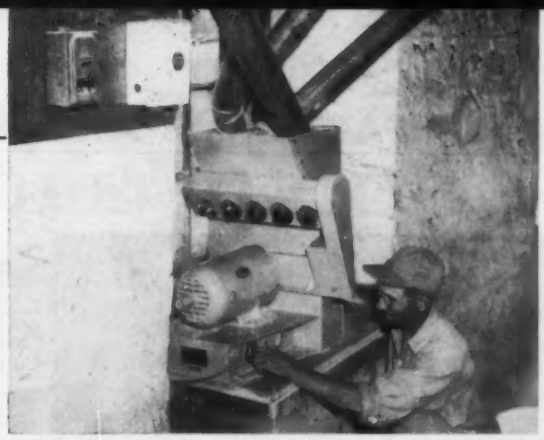
Here's a way to double the value of breakers in place—at one third the cost of new equipment.

It's simple, and your Westinghouse sales engineer can give you the details quickly. When he knows the style and rating of your present breakers, he can suggest the proper interrupter replacement that will step up the capacity of your breakers 50 to 200%. You make the installation. No need to relocate or remount equipment. That's all there is to it.

In addition to keeping breaker capacity up and equipment investment down, you get additional benefits with new Westinghouse interrupters which will improve the quality and economy of breaker operation. The exclusive magnetic, multi-flow or tubular De-ion® grid interrupters extinguish arcs faster than ever before, which means less oil deterioration, less maintenance.

So, if you need one or more breakers that your budget won't allow, the Breaker Modernization Plan can probably solve your problem. Look into it. Call your Westinghouse sales engineer now, or write to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-60879

YOU CAN BE SURE... IF IT'S
Westinghouse



FARMER FRANK MIKUL, Grandville, Wis., sets the timer, one of five dials on his automatic mix-mill. Mikul figures unit can pay for itself in year's time

SMALL BOY, SMALL MOTOR: This youngster, turning on the feed grinder, handles all grinding and ration mixing for the herd on farm near Green Bay

Beating the 3-Phase Feed Mixer Problem

SALES
Rural

Are mounting 3-phase motor demands plaguing your rural service? One answer may lie in 2 hp, single-phase mix-mill developed by Wisconsin utility

With its farm load growing steadily, Wisconsin Electric Power Co has been faced with a problem common to many another utility. As three-phase service is extended to more and more of its farm customers, the number of requests for large three-phase motors for feed grinding multiply.

To protect itself from the need of supplying energy to these large motors for the relatively short use that farmers make of them, the utility set to work to find a satisfactory method of grinding feed with smaller hp units.

Under direction of Ralph Bowen, farm electrification engineer, plans were crystalized and in 1949 an automatic mix-mill, operating on a 2 hp, single-phase motor was introduced. The unit which combines the regular feed grinder and feed mixer into one machine was a sensation wherever it was displayed. It soon attracted the interest of a farm equipment manufacturing firm, and with Bowen's help a unit was ultimately developed for the market.

Although it operates on only a 2 hp motor, it is believed to be large enough to handle all the feed grinding needs of 200 animals.

Here's how it works according to Bowen: "Before the grinding and proportioning operation begins, correct mechanically measured proportions of each kind of grain or concentrate to be used are determined by adjustments of four dials on the front of the proportioning unit which then accurately and automatically control the exact quantity of each item desired. In order that the motor can operate at peak efficiency, the total quantity of material to be ground is then regulated by setting a fifth dial.

"After being correctly proportioned and ground, the fresh mixed ration is then delivered into a feed cart or bin ready for use. The unit has an automatic timer somewhat similar to that used on a silo unloader. After operating the equipment a few times, the farmer determines exactly how long the equipment must operate to grind just enough ration for a single feeding. He then can set the timer to control the whole operation automatically. With this equipment, and figuring the cost of electricity at about 2¢ per kwhr, the ration that is most commonly used on farms today can be mixed, ground and delivered for about 1¢ per 100 lb."

What do farmers themselves think of these smaller automatic units? Farmer Frank Mikul, Grandville, Wis., only grinds about 25 tons of feed per year, but he figures his unit will pay for itself in about one year's time. The mix mill is so automatic and simple to use that some farmers turn the complete feed grinding and mixing chore over to their youngsters.

But most interesting thing about the development, says Bowen, is the fact that this 2 hp, single-phase motor does the feed grind job for the farmer who would normally use a 15 hp, three-phase motor for the same application, and he probably would also use a 3 to 5 hp motor on the mixer.

Besides the mix-mill, Bowen points with pride to still another new innovation in farm equipment: A sheller-crusher which can be used as a companion piece to the mix-mill. Also operating on a 2 hp motor, and nearly completely automatic, it does two jobs. It not only shells the corn like a regular corn sheller, but if the farmer chooses, it can break up the cobs, too, to supply cob meal for his cattle.

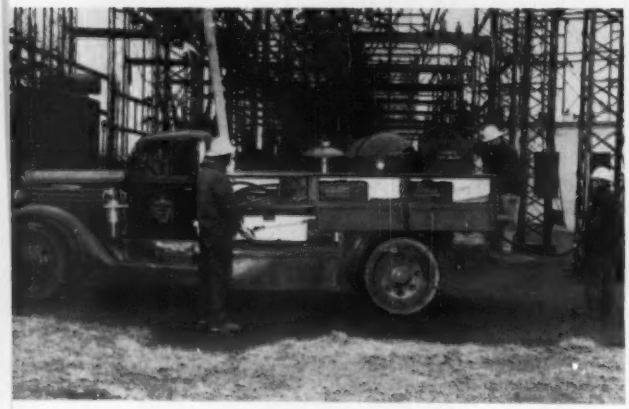
Bowen invites those interested in further details to write Wisconsin Electric Power Co, Racine, Wis.

Kaiser: New Reel Packaging

This new protective packaging eliminates the use of regular wood batting on large reels of electrical conductor. Kaiser Aluminum & Chemical Corp designed and perfected the method at its Newark, Ohio, Works.

The packaging consists of a one-in. fibrous batting that is sandwiched between two $\frac{3}{32}$-in. layers of Kraftboard. Kaiser says the material not only keeps cable clean, but can be removed quickly and burned easily.

Kaiser is using the material on 50, 57 and 63-in. reels. A spreader bar is suggested for sling unloading to eliminate cutting the flanges of the reel.

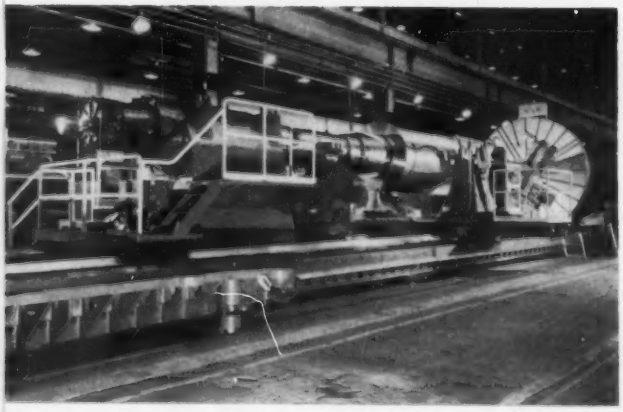


Ansul: Fire Fighter for PP&L

This truck has been adapted to dry-chemical fire-fighting purposes by Pennsylvania Power & Light Co in conjunction with Ansul Chemical Co, Marinette, Wis.

PP&L believes the truck is one of the first dry-chemical fire trucks in the electrical industry. It is based at Siegfried substation but can be called into service at other PP&L stations in a 25-mile radius.

The truck has a 500-lb capacity dry-chemical tank and a 140-gal water tank, both pressurized by nitrogen cylinders. Other features include an extension ladder with spot light, ample hose, asbestos suits, and gas masks.



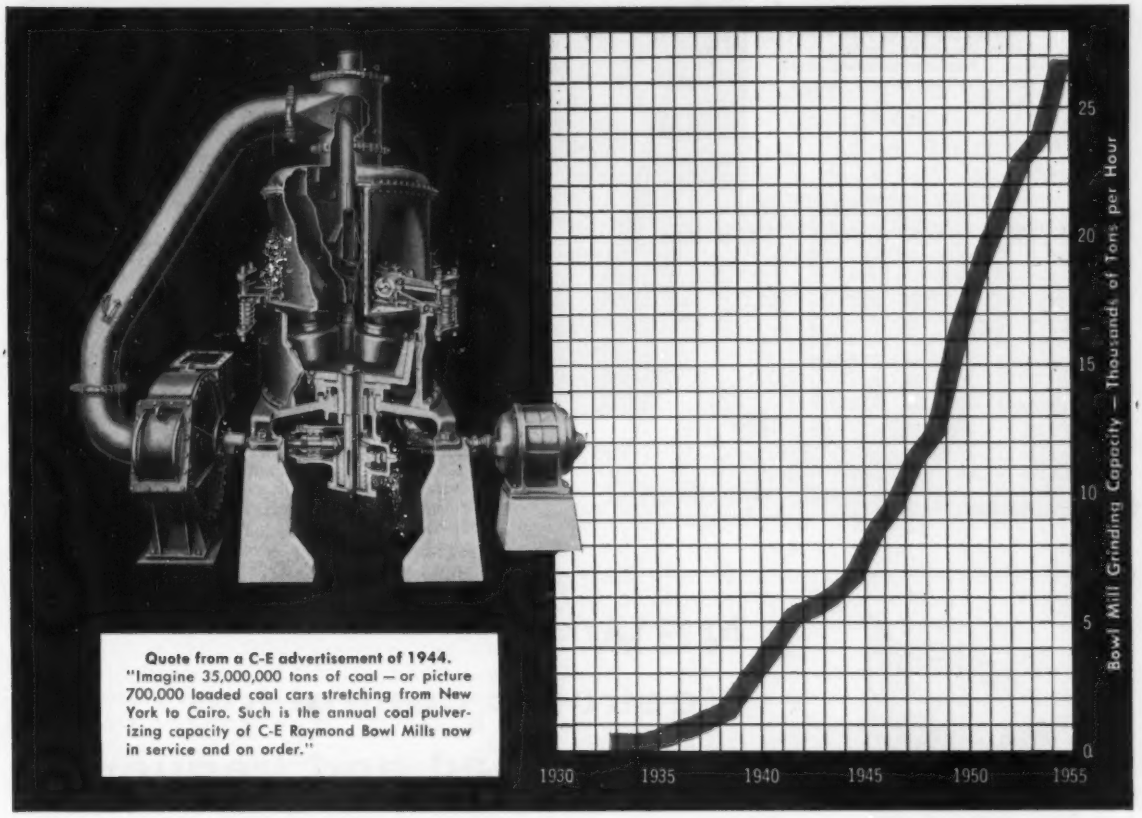
A-C: Giant Engine Lathe

Allis-Chalmers Mfg Co recently installed a 144-in. engine lathe at the West Allis Works. The lathe is being used to machine a rotor forging for a 300,000-kw steam turbine-generator unit.

The lathe measures 60 ft between centers. Magnetic amplifier circuits control the lathe's 200-hp drive motor and the motors used for supporting generator excitation. The 10-hp carriage armature is electronically controlled. The carriage follows the spindle speed and gives a constant feed which is adjustable from 0.003 to 0.75 in. per revolution.

(*More M&M on page* 59)

A NEW LOOK AT A NOTABLE RECORD


Quote from a C-E advertisement of 1944.
"Imagine 35,000,000 tons of coal — or picture 700,000 loaded coal cars stretching from New York to Cairo. Such is the annual coal pulverizing capacity of C-E Raymond Bowl Mills now in service and on order."
Bowl Mill Grinding Capacity — Thousands of Tons per Hour
0
5
10
15
20
25
1930
1935
1940
1945
1950
1955

When the paragraph quoted above was written in 1944, the C-E Raymond Bowl Mill had been on the market just 10 years. Obviously it had achieved tremendous acceptance in the power generation field. But see what has happened since. Those 700,000 cars have grown to 2,850,000* which, in a single train, would more than encircle the earth at the latitude of New York.

No one factor could possibly account for this widespread acceptance. Rather it is the fact that the Bowl Mill's record of performance in many hundreds of installations has been outstanding in all these important respects...

- **power consumption**
- **maintenance costs**
- **control characteristics**
- **ability to maintain capacity with wet coal**
- **ability to maintain fineness through life of grinding elements**
- **quiet vibrationless operation**

The Bowl Mill's top performance on *all* these counts is the reason why utility engineers continue to accord it such widespread preference.

*Equivalent of 27,200 tons per hour shown on chart.

B-912

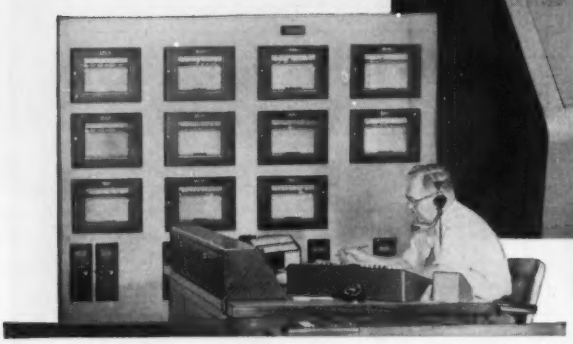
COMBUSTION ENGINEERING

C-E

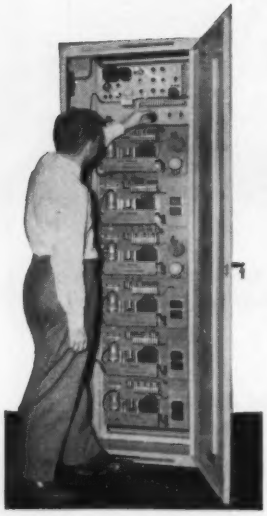
Combustion Engineering Building
200 Madison Avenue, New York 16, N. Y.

Steam Generating Units • Nuclear Reactors • Paper Mill Equipment • Pulverizers • Flash Drying Systems • Pressure Vessels • Home Heating and Cooling Units • Domestic Water Heaters • Soil Pipe

CONTROL CONSOLES *are custom engineered by Honeywell for the system or station. Operators can choose flat frequency, flat tie line, or tie line bias control . . . can set up automatically maintained incremental loading schedules.*



HIGH-SPEED TELEMETERING *operates over carrier, wire, or micro-wave channels. Vital information is displayed on easily-read instruments on the dispatcher's panel.*



CONTROL SERVOS *use true feedback techniques for high stability. Speed of response is readily matched to generating system characteristics.*

NEW

electronic control for system load and frequency

HERE'S the fast, accurate, all-electronic way to regulate network interchange . . . system load dispatching . . . generation of individual units in stations. Engineered and built by Honeywell, this new type of control uses highly stable, dependable servo circuits.

It includes continuous, high-speed telemetering using distortion-proof pulse rate transmission. A single channel is usually all that is needed for all control signals for each station. Area and net power totalizing is done rapidly and accurately by electronic circuits.

Control is designed to provide maximum economy of system operation and accurately maintain schedules. "Building block" design simplifies the initial installation . . . makes expansion easy. Ask your local Honeywell sales engineer to discuss your system's requirements . . . he's as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, Wayne and Windrim Avenues, Philadelphia 44, Pa.—In Canada, Toronto 17, Ontario.

MINNEAPOLIS
Honeywell
BROWN INSTRUMENTS
First in Controls

Truck with Elbowed Boom Facilitates Line Clearance

Men aloft in two crow's nests at end of elbowed boom, mounted on International truck, keep the way clear for the lines of Union Electric Co of Mo. The 40-ft Skyworker boom is operated by power takeoff through a hydraulic pump. Controls are operated from the crow's nest. The International Harvester Co truck is equipped with a 14-ft all-steel platform body and is rated at 21,000 lb gross vehicle weight.

Resistance Welder Group Reports Record Business

Resistance Welder Manufacturers' Association, Philadelphia, reported new business for January showed an increase of nearly 186% over the similar month of 1955. The $5.5 million in orders received during January 1956 is said to be the greatest monthly figure in the Association's history.

Shipments for this January, in comparison with the same period in 1955, reflected an increase of 26%.

Association members reported backlog of orders on hand at the end of January amounting to approximately $15 million.

New Barth Cable Puller Uses Reversible Motor

Barth Corp, Cleveland, Ohio, has an electric powered cable puller to eliminate manual pulling of wire through conduit. The designer is W. E. Raney of Barth's research staff.

This cable puller has a 2-hp, 15-min rated reversible motor with dynamic braking. The device pushes a metal tape with a ball-end through the conduit. When the tape emerges from the far end, the cable is attached, and tape and cable are pulled back through the conduit. Considerable man-hours saving is claimed for the pulling operation.

M&M BRIEFS

General Electric Co has reported these recent developments:

• Announcement revealed that 100 GE gas turbines have accumulated over one-million hours of operation or the equivalent of 114 machine years' operating experience. Gas turbines have been in commercial production for only seven years.

• Five luminaires are known as Fluorescent's First Family for urban and highway lighting service. They range in length from 2 to 7 ft, and in light output from 2,700 to 64,000 lumens. Smallest unit, form 202S, uses two 2-ft lamps and is designed for lighting residential streets. Largest, form 1206S, is a 7-ft, 12-lamp luminaire designed for "whiteway" applications. Previous largest units generated 21,000 lumens.

Westinghouse Electric Corp will manufacture 11 additional 138-kv outdoor compressed air circuit breakers for Consolidated Edison Co of New York, Inc, which ordered 11 similar breakers from Westinghouse in 1955. The breakers have an interrupting capacity of 10-million kva and will be of the dead metal tank design. Air pressure will be approximately 250 psi. The breakers are believed to be the first outdoor compressed air breakers of this rating to be built for an electric utility by an American manufacturer.

Union Carbide Development Co has been formed as a new division of Union Carbide & Carbon Corp. Long-term corporate planning and evaluation of new business opportunities will be important objectives of the new company. Birny Mason, Jr, secretary of Union Carbide, has been appointed president of the subsidiary. R. E. Cornwell, E. J. Fox, and J. J. Murphy have been named vice presidents.

Herculite Protective Fabrics, Inc, has moved into its new plant at 140 Little St, Belleville, N. J. Approximately 60% additional floor area is now provided for the firm, manufacturer of Herculite—an industrial nylon-plastic protective fabric. This product is said to handle like silk, yet is as strong as steel mesh, and is fire, cold, abrasion and chemical resistant. Applications of Herculite are as equipment covers and tarpaulins.

Crane Co and Vitro Corp of America have entered into a joint operation to produce thorium, rare earths and heavy minerals from monazite, as well as rutile, ilmenite, zircon and kyanite. The two companies will assume equal ownership of Heavy Minerals Co, its mining subsidiary Marine Minerals, Inc, and associated operations. Combined investment will be about $6 million by the end of 1956.

BUSINESS OUTLOOK

Electrical World
MARCH 26, 1956

Signs now multiply that a business upturn is near at hand. Odds now favor rising production—with seasonal variations—for the rest of the year. The price trend is clearly upward. In fact a real inflationary boom, with dangerous speculative overtones, could get underway, although it doesn't, on balance, seem likely so far. **The new indications are particularly favorable for consumption and business investment.**

• • •

Consumers. There's absolutely no letup in consumer's intentions to buy. That's the report of the new survey prepared by the Michigan Survey Research Center. **About the same proportion of families interviewed expected to buy a car as last year.** Of course you can't take these surveys as gospel. Last year's survey gave no indication of the dramatic rise in car sales that actually occurred. Just the same, it's reassuring that this year there's no positive evidence of any weakening of consumer's intentions. It makes the nightmare of a downward spiral started by massive cuts in autos seem even more unrealistic than before.

• • •

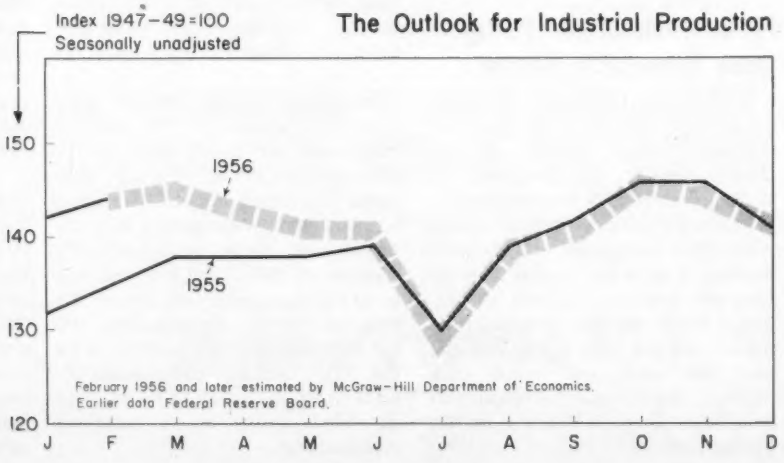
Other consumer items should also do well. According to the survey, **more than one family in four plans to buy furniture or major household appliances in 1955,** and more than one family in five plans a major expenditure on household improvement or maintenance. This is about in line with last year. The biggest surprise, though is in housing. **The number announcing intentions to buy a new house is greater than in any previous year.**

• • •

Investment. Last fall the McGraw-Hill capital spending survey indicated business was planning to spend **30% more in manufacturing facilities in 1956 than it had in 1955.** A new survey made by the Security Exchange Commission and the U.S. Department of Commerce confirms this estimate. **The new survey projects a 31% increase.** Outside of manufacturing there's evidence that business has been substantially **upping** its investment plans. **If these plans are carried through, 1956 just has to be a year of outstanding prosperity.**

• • •

The upswing has actually started. March steel production has averaged 100% of capacity. New car sales appear to have turned the corner and are now running about 13% ahead of February.



WHAT THE WELL DRESSED LINEMAN WILL WEAR...

from one convenient source...

Graybar

Belts to bits . . . climbers to come alongs . . . linemen work more efficiently and in greater safety with equipment they know and respect.

For special or emergency orders, or for regularly-scheduled replacements, your nearby Graybar office or warehouse can furnish tools, supplies and equipment best suited to the job. You make your selection from the finest, most complete lines of products available – made by the nation's leading manufacturers. Graybar ships your order promptly. You save purchasing time and paper work.

Call Graybar for all of your other pole-line needs as well. You can rely on your local Graybar office or warehouse to provide complete, accurate information on everything electrical for pole-line construction and maintenance. For special help on tough or unusual problems, feel free to ask for the assistance of a Graybar Outside Construction Specialist.

634-93

GRAYBAR ELECTRIC COMPANY, INC.
420 Lexington Avenue, New York 17, N. Y.

Call Graybar first for...

*Graybar Everything Electrical Graybar Electric Company
Since 1869 * Reg. U.S. Pat. Off.

IN OVER 130 PRINCIPAL CITIES

IN THE INDUSTRY

Power Economics for Aluminum Industry

Low cost power in ample quantities, transmission systems to provide backup were among the factors which drew aluminum producers to Ohio Valley

Recently announced plans for concentrating much of the new round of aluminum production expansion in the Ohio Valley vividly illustrates the current phase of power economics for that industry. As one of the heaviest users of electric power per unit of production, the aluminum industry must carefully consider its power economics in locating new production facilities.

Availability of low cost, long term fuel supplies, proximity to markets, low cost water transport were, of course, important reasons for the planned shift of aluminum production. But these do not detract from the key requirement of an economical and dependable supply of power.

A vital factor in this phase of power economics is today's concept of the modern super power system with its efficient concentration of large generating units in stations linked by EHV transmission lines capable of carrying large blocks of power over long distances. These modern units have enabled the industry to improve its coal rate some 26% in the past decade. The industry as a whole used 1.3 lb of coal to produce a kwhr in 1945. Last year it required only 0.96 lb to generate a kwhr of electricity. The new plants which will serve the aluminum industry will be vastly more efficient than this average for the utility industry.

Of equal importance is the EHV transmission system that now ties together the network in the valley. The backup power that this system can provide to any major power user was an important factor in the aluminum decision. It does much to insure the dependability of power supply.

The present phase of power economics for the aluminum industry is a long way from the one that preceded it. That phase was characterized by government-subsidized hydroelectric power concentrated mainly in the Tennessee Valley and the Columbia Basin. Although neither offer the nearness to markets or the dependable power sources of the Ohio Valley, the low-priced power was sufficient attraction for the aluminum producers.

But several things have happened to change that picture. Among the more important is the diminishing availability of economical hydro sites. Hydro projects now being developed cannot match the cost per kw of installed capacity of the earlier ones in the Tennessee Valley and the Columbia Basin. On the same basis the costs of steam plants trend downward.

A second factor is that the climbing demand for aluminum puts a greater premium on a dependable power supply. A large share of the power purchased from hydro projects was on an interruptible basis, and potlines were down for days at a time. The Ohio Valley steam power will be on a firm basis.

Third factor is that aluminum producers can count on increased power supply to meet their increasing demands in the Ohio Valley. On government projects such power expansion often depends on the political whims of Congress.

TECHNICAL NOTES

Corrosion protection needs economic guidance for greatest benefits. Sometimes extending life of old facilities does not justify protection cost.

Coal pile fires are rare on systems that use heavy earth-moving and bulldozer equipment to distribute and compact the coal.

Watts provide intelligence for switching capacitor banks in substations where operators are not available and current-voltage control is too sensitive.

Basic factor in mitigating corrosion is to determine whether its cause is stray current or galvanic action.

Rubber insulated cable, or a Neoprene jacket over lead sheath, guards against corrosion in duct sections where water can collect or where the soil is conductive to corrosive attack.

A hermetically sealed transformer is probably the most reliable component of a secondary network system. Cable faults on one system exceed transformer faults by 35 to 1, stimulating a desire to use only grounding switches instead of the customary 3-position type.

Corona interference with radio reception often fails to disturb VHF TV.

British Report Favors Present Value

Inquiry into the nationalized electricity supply industry argues that depreciation should be made at 'current price levels' rather than original cost

Present value depreciation is favored in a report by a special committee which has investigated Britain's electricity supply industry.

This report was issued in January, 1956, and was prepared by a seven-man committee, consisting of industrialists and bankers, an accountant, a former utility official, a professor of economics, and a labor leader.

Britain Used Original Cost

Britain, whose utilities prior to nationalization were regulated substantially on a basis of original cost depreciated and where the earnings on common stock were the final criteria of the reasonableness of rates, is also a country where the economic realities of life, among them inflation, have received due recognition irrespective of the ownership of property.

Under the chapter dealing with financial policy, the committee in drawing a very proper distinction between private unregulated industry and a state owned monopoly, said: In dealing with the provisions for depreciation, "the primary question to be considered here is what costs ought to be taken into account in assessing what should be passed on to consumers in tariffs. The secondary question is the way in which the amount so determined should be shown in the industry's accounts. We think it important to keep these questions distinct. First is a policy matter which has to be settled for the purpose of fixing prices, second is a matter of accountancy presentation.

Replacement vs Historical Cost

"There has been much dispute in industrial and accounting circles as to whether, in a period of inflation, the difference between a depreciation charge based on 'replacement cost' and one based on 'historical cost' should be shown in a company's accounts before arriving at a figure for profit or whether that difference should be shown as an appropriation of profit.

"In industries where prices result from a process of competition between firms the calculation of depreciation is primarily a matter of financial policy concerning the disposal of the revenue of the business, e.g. the amounts that should be kept for the replacement of assets, reserves and carry-forward or used for dividends. The depreciation calculation is not in such cases a direct determinant of prices.

"In the case of a state-owned monopoly, however, on which competitive forces do not operate strongly, prices must be determined by a process of calculated assessment. It seems to us that a proper element in arriving at these prices is the cost of the resources used up in the process of manufacturing and delivering the product—in this case electric power. **It also seems to us that this cost should reflect current price levels rather than those ruling at the time when the plant was originally installed"** (Emphasis supplied).

Depreciation Fund Cited

Significantly, the committee went on to say that "A depreciation fund based on historical cost would not, in a period of inflation, be sufficient to do this unless improved methods of generation and distribution reduced the volume of plant needed by an amount that would counterbalance the increase in plant costs due to rising price levels."

The committee noted that the industry had in fact in the last fiscal period set a shorter book life on its assets than experience dictates and that, in addition, supplementary depreciation reserves have been accrued which in effect have resulted in the setting up of economic depreciation before arriving at a so-called "surplus".

The committee concluded its argument with respect to the adequacy of accounting under inflationary conditions by saying that "The principal objects of its accounts should be to show clearly and unambiguously how during the year under review it has complied with the financial provisions of the statute and directions (if any) governing its operations.

Cost Items Should Be Considered

"Among other things it should show just what items of cost have been taken into account in fixing its charges. We have said that one item should in our opinion be depreciation at current price levels. We think that the adequacy or otherwise of this figure can be more easily judged if it is shown before arriving at 'surplus'. To have to add 'depreciation', 'surplus' and 'supplementary depreciation reserve', in order to see what consumers have been charged and why, is confusing.

"It can easily be misleading, as for example, if it suggests that in 1954-55 the industry made a 'profit' of 18¾ million pounds when in fact it barely covered necessary charges. We see no practical or theoretical reason why the clearer course of making the whole charge before arriving at 'surplus' should not be taken, and we recommend that it should be taken."

Reserve Question Raised

As to the general question of reserves which would cushion the industry against a decline in Britain's industrial economy, the committee said: "We have already described the industry's past policy with regard to reserves and shown how modest have been the surpluses carried forward. We now consider whether consumers should be asked to pay prices which would enable the industry to do any more in a given year than cover costs, including depreciation, calculated as closely as possible."

While the committee noted that forecasting the production of electric power was probably the easiest of all economic forecasts, nevertheless, ". . . forecasting the future is fraught with uncertainty. If, for example, there were a trade depression the demand

for power might be significantly reduced for the period of depression and the smaller volume of business would not be accompanied by a corresponding fall in expenditure. The industry should in our judgment carry sufficient reserves to cushion it against short-run changes in demand and costs and the need for violent or frequent alterations of tariffs."

In pointing out the fact that in effect earnings are overstated due to the inadequacy of depreciation reserve accruals being based as they are on original cost, the committee went on to say that "We should regard it as no more than a modest provision against contingencies if this industry, with its annual revenue of 400 million pounds and capital liabilities of over 1,000 million pounds, were for the time being to aim at earning, after providing for depreciation on the basis suggested above and interest charges, an annual average of, say, 1% on the capital employed.

"If in 1954-55 we regard the industry as having already provided depreciation at the level we are recommending, (i.e. on present value of assets) (Parenthesis supplied) it follows that it would have needed to earn an additional ten million pounds before it could be considered in our judgment to have met its costs, maintained its capacity intact and secured a modest contribution to reserves."

The foregoing should make interesting reading to all those proponents of original cost whether or not they believe in outright government ownership of public utilities, or to those who believe that private ownership can not long survive under the fallacies of original cost.

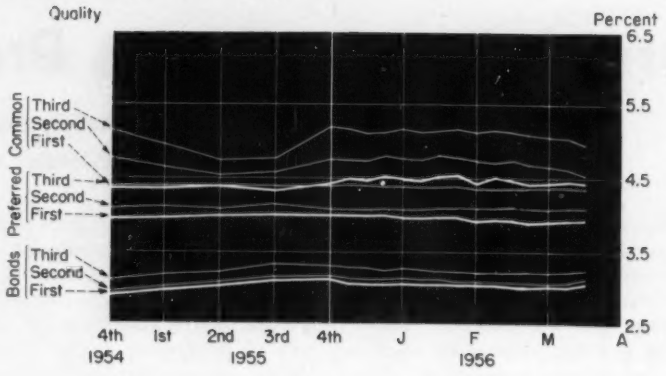
Toledo Ed Gets PUC Ok to Sell Bonds Privately

Ohio Public Utilities Commission has approved the negotiated sale of $15 million in 30-year first mortgage bonds by the Toledo Edison Co.

The commission decided that Toledo Edison had obtained a fair price and a fair interest rate of 3⅜%, considering the present bond market, and had the privilege of either a negotiated sale or competitive bidding.

Halsey, Stuart & Co, Chicago, sought competitive bids for the issue. First Boston Corp won the bonds.

Today's Utility Yields (%)



QUALITY	BONDS 1st	BONDS 2nd	BONDS 3rd	PREFERRED STOCKS 1st	PREFERRED STOCKS 2nd	PREFERRED STOCKS 3rd	COMMON STOCKS 1st	COMMON STOCKS 2nd	COMMON STOCKS 3rd
Mar. 15	3.06	3.11	3.23	3.95	4.10	4.38	4.43	4.52	4.95
Mar. 8	3.02	3.07	3.21	3.94	4.10	4.39	4.46	4.61	5.06

Utility Earnings

COMPANY	PERIOD MONTHS ENDED		NET INCOME 1956	NET INCOME 1955	EARNINGS PER COMMON SHARE 1956	EARNINGS PER COMMON SHARE 1955
Arizona Public Service	12	Jan.	$5,534,000	$4,665,000	$1.36(a)	$1.42(a)
Carolina Power & Light	12	Jan.	9,500,158	7,968,263	1.72(b)	1.65(b)
El Paso Electric	12	Jan.	2,184,494	2,141,803	2.45	2.41
Gulf States Utilities	12	Jan.	10,606,437	9,512,495	2.15	1.89
Public Service of Indiana	12	Jan.	12,606,161	12,275,090	2.35	2.40
Virginia Electric & Power	12	Jan.	19,501,887	17,049,440	2.60	2.24

Notes—(a) Based on average shares outstanding; (b) Based on shares outstanding at end of each period.

Utility Financing

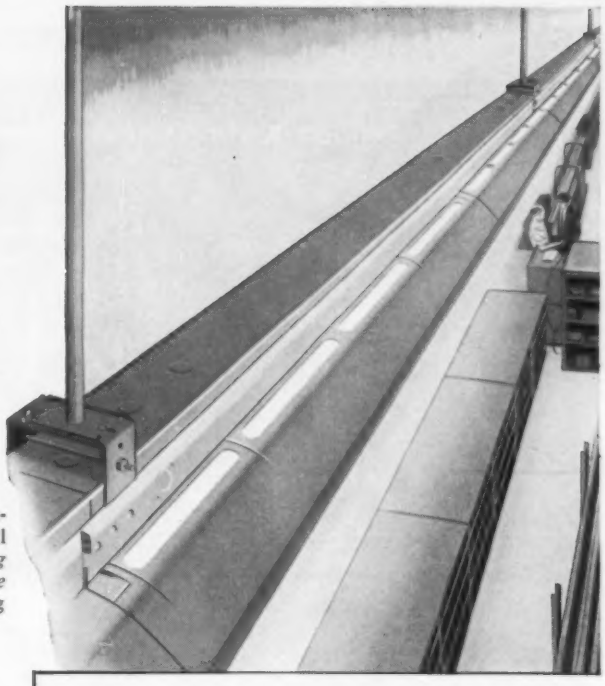
COMPANY AND DESCRIPTION	AMOUNT OF OFFERING (000)	OFFERING PRICE	YIELD TO PUBLIC
MARCH 15-21			
BONDS			
Alabama Power—1st mtg 3⅛% due 1986	$14,000	102.824%	3.35%
Narragansett Electric—1st mtg due 1986	10,000	(Postponed till Mar. 22)	
Pacific Gas & Electric—1st mtg 3⅛% due 1988	25,000	101.125	3.32%
PREFERRED STOCK			
Louisiana Power & Light—70,000 sh 4.44% $100 par	7,000	$102.06	4.35%
SCHEDULE FOR MARCH—APRIL			
BONDS			BID DATE
Georgia Power—1st mtg due 1986	$12,000	.....	Mar 29
Florida Power & Light—1st mtg due 1986	15,000	.....	April 3
Columbus & Southern Ohio Electric—1st mtg due 1986	12,000	.....	April 3
Duquesne Light—1st mtg due 1986	20,000	.....	April 4
Kentucky Utilities—1st mtg due 1986	10,000	.....	April 10
Southern California Edison—1st mtg due 1981	40,000	.....	April 17
PREFERRED STOCK			
Kansas City Power & Light—120,000 sh $100 par	$12,000	.....	April 10
Long Island Lighting—120,000 sh	12,000	.....	April 26
COMMON STOCK			
Central Illinois Light—100,000 sh (to be offered commonholders on 1-for-10 basis, record April 3 to expire April 19)	.....	.....	.....
El Paso Electric—56,025 sh (to be offered commonholders on 1-for-15 basis, record April 4 to expire April 25)	.....	.....	.....

Why the Sylvania

DIAMOND-I

LIGHTING FIXTURE

is a plant engineer's best friend

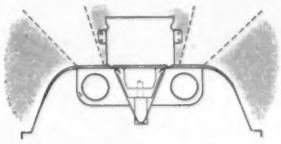


Better Plant Illumination

Sylvania's exciting new semi-direct fixture is taking industry by storm! Enlarged reflector slots release a full 25% of its light upward. *Result: More light on the ceiling . . . reduced contrasts overhead . . . less shadow and glare on work surfaces below!* Optimum 30° crosswise shielding protects eyes from direct glare of lamps.

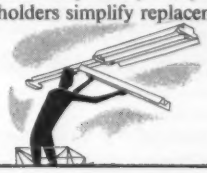
Maximum Lighting Efficiency

By unleashing more light upward which would normally be "trapped" between lamp and reflector, the *Diamond-I delivers an extremely high 89% lighting efficiency!* More light on the job means better seeing and working conditions, better morale, better quality and rates of production.



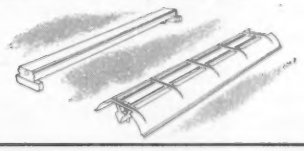
One-Man Maintenance

With 4-foot reflector-shields on both 4- and 8-foot units, one man can do it all alone! Reflector-shield is lightweight, easy to handle . . . secured to channel assembly using 2 captive bolts which can't drop out. Slots in reflector induce upward heat draft which helps carry away dust particles. Multi-socket lampholders simplify replacement.



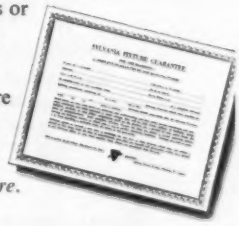
Quick and Easy to Install

Simply install the one-piece channel assembly, then fasten on the reflector-shield unit by its 2 captive bolts. Sufficient knockouts and slots in the channel assembly will accommodate all basic installation methods. Full-length grooves enable you to use slide-grip hangers.



2-year Guarantee—RLM approval

The Sylvania Diamond-I meets or exceeds all new RLM specs! Here's the industrial fixture of tomorrow, ready to be put to work for you *now*. What's more *—a replacement guarantee protects you against defective materials and workmanship for 2 years from date of manufacture.*



Send the coupon for complete specification information. ▶

SYLVANIA®

. . . fastest growing name in sight

LIGHTING • RADIO • ELECTRONICS
TELEVISION • ATOMIC ENERGY

Sylvania Electric Products Inc.
Dept. C-88, Lighting Division—Fixtures
One 48th Street, Wheeling, West Virginia

☐ Please send your complete data folder F-692 on the "Diamond-I."

☐ Have a Sylvania lighting specialist call on me.

Name_____ Title_____

Organization_____

Address_____

City_____ Zone____ State_____

STATISTICS

Trillion-Kwhr Year A Decade Away, FPC Predicts

(Production in Billions of Kwhr)

Region	1960	1965	Trillion-Kwhr Year	1970	1975	1980
I	144.2	175.6		208.5	243.2	279.9
II	147.9	186.2		222.4	266.3	312.1
III	148.2	183.7		222.5	269.8	324.4
IV	94.4	122.2		151.5	184.2	224.2
V	73.4	95.4		119.7	145.4	172.4
VI	14.8	19.8	1966	24.9	30.1	35.3
VII	64.6	82.5	or	104.2	129.0	159.3
VIII	67.1	91.2	1967?	119.5	151.5	187.9
U. S.	754.5	956.5		1,173.2	1,419.5	1,695.5

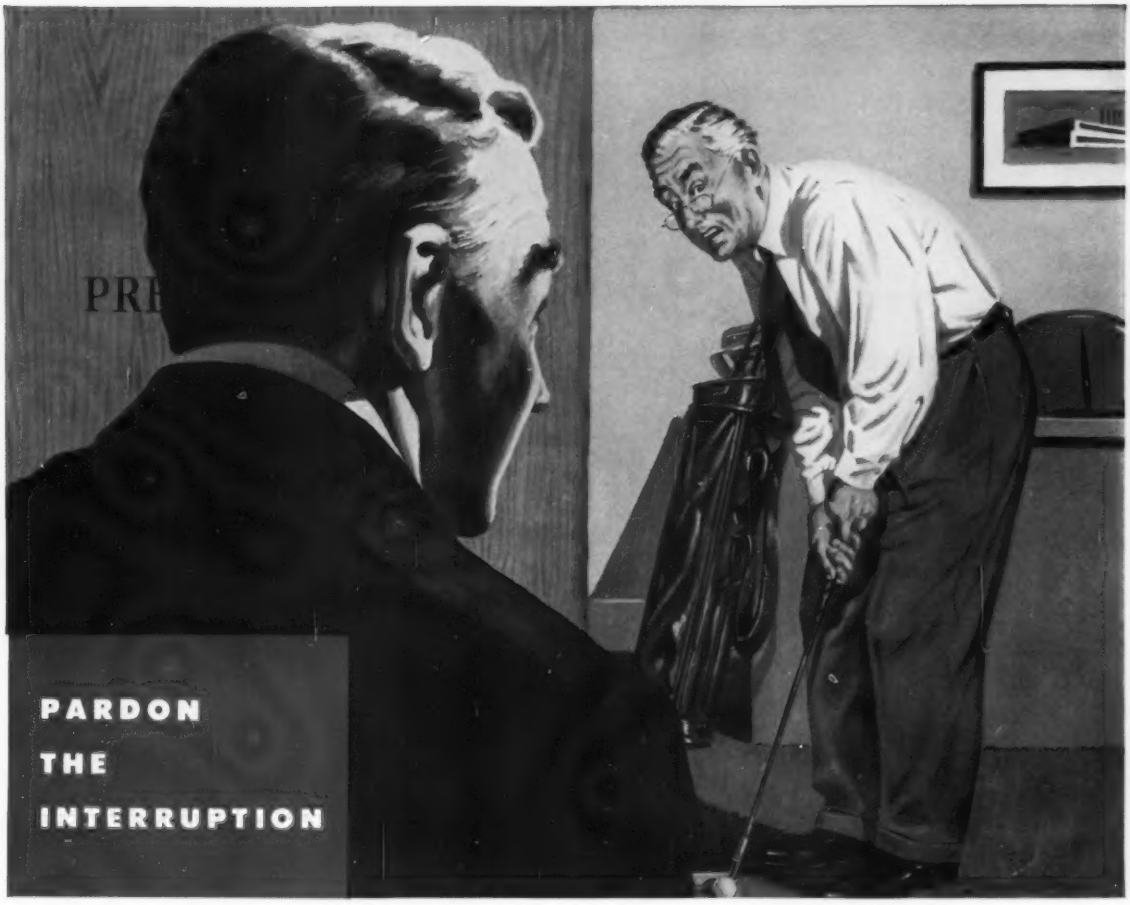
Source: Federal Power Commission

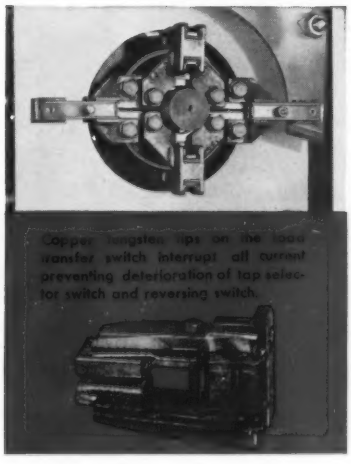
Power Statistics . . .

		Latest Month	Preceding Month	Year Ago	Annual Change%
Capacity } million kw	Jan.	114.55	114.37	103.62	10.5
Peak—Class I Systems } million kw	Dec.	98.2	96.4	85.7	14.6
Estimated Dec. '56 Peak } million kw	Dec.	105.27	104.55	102.64	2.6
Production—billion kwhr	Jan.	51.12	50.72	43.96	16.3
Hydro		9.36	9.31	9.43	−0.7
Fuel		41.76	41.41	34.53	20.9
Sales—billion kwhr	Dec.	45.19	43.07	38.06	18.7
Residential		12.25	10.71	10.89	12.5
Commercial		6.81	6.61	6.19	10.0
Industrial		23.75	23.37	18.75	26.7
Other		2.39	2.38	2.23	7.2
Fuel Consumption	Jan.				
Coal—million tons		15.22	14.77	12.02	26.6
Oil—million barrels		8.22	8.54	8.91	−7.7
Gas—billion cu ft		68.27	70.00	65.13	4.8
Net Income Class A & B Co's—$ million	Nov.	104.29	95.67	95.12	9.6
Residential Customers—millions	12 mos.	44.41	44.30	43.14	2.9
Revenue per kwhr	ended	2.64¢	2.65¢	2.69¢	−1.9
Avg kwhr per customer	Dec. 31	2,751	2,728	2,549	7.9
Avg annual bill		$72.63	$72.29	$68.57	5.9

Business Statistics . . .

Indexes: 1947-49 = 100					
FRB Industrial Production	Feb.	144	143	135	6.7
ENR Construction Cost	Feb.	142.6	141.8	135.3	5.4
BLS Cost-of-living	Jan.	114.6	114.7	114.3	0.3
NEMA Sales	Dec.				
Insulation materials		160	155	138	15.9
Electric appliances		101	88	74	36.5
Wholesale prices	Dec.				
Motors and generators		127.2	127.0	121.8	4.4
Transformers and regulators		129.2	129.2	128.1	0.9
Switchgear and fuses		145.9	145.9	135.3	7.8
GNP—annual rate—$ billion	4th Qtr.	397.3	392.0	367.1	8.2




Copper tungsten tips on the load transfer switch interrupt all current preventing deterioration of tap selector switch and reversing switch.

Interrupting electricity is just like interrupting the boss. No matter how you do it, it's a touchy situation. Electricity, when interrupted, presents a touchy situation, too!

Yet the primary function of Moloney Load Tap Changing Transformers is interrupting . . . switching to various taps . . . and the load tap changing equipment must bear fully the brunt of the destructive power unleashed with each break in current flow.

That's why Moloney uses switch contacts . . . for all current interrupting duty . . . made of a combination of copper and tungsten that conducts electricity best while successfully resisting arc erosion.

All this, plus the minimum arcing duty required of Moloney load tap changing equipment means greater durability, longer life and overall transformer dependability . . . for your utility system.

Specify Moloney . . . Get Dependability at its Best.

ME55-47

MOLONEY ELECTRIC COMPANY

Power Transformers • Distribution Transformers • Load Tap Changing Transformers • Regulating Transformers • Step Voltage Regulators • Primary Unit Substations • Secondary Unit Substation Transformers • Network Transformers • Series Street Lighting Transformers • Subway Transformers • Industrial Dry Type Transformers • Capacitors • Magnetic Components for Electronics

SALES OFFICES IN ALL PRINCIPAL CITIES • FACTORIES AT ST. LOUIS 20, MO. AND TORONTO, ONT., CANADA

Get the Regul

Tailor T
System

Vari-Amp feature has built-in provisions for system needs

Now you can tailor a voltage regulator to your exact requirements—no need to accept ±10% reg your system can operate more profitably at a differe The *Vari-Amp* feature on Allis-Chalmers voltage r provides *five* current ratings — 25 regulating comb

You can even utilize unequal ranges of regulatio how it might work on a distribution regulator: set 6¼% range in the raise direction, providing 135% capacity, and for 10% in the lower direction, at current capacity.

In addition to providing for many variations to s different systems, the *Vari-Amp* feature gives you your regulation dollar by permitting increasing ca five steps. On a distribution regulator, for example get 160% of current capacity by reducing the rang lation to ±5%.

25 REGULATING COMBINATIONS

This regulator equipped with

Vari-Amp Feature

ALLIS-CHALMERS

Get the complete story on the unusual opport matching a regulator to your needs and getting ext ity with the *Vari-Amp* feature. Call your nearby A or write Allis-Chalmers, Power Equipment Divis waukee 1, Wisconsin.

ALLIS-CHA

ulator you can

To Your
m Needs

your system's
% regulation if
different range.
tage regulators
combinations.
ulation. Here's
: set a unit for
135% current
n, at 100% of

s to suit many
s you more for
ng capacity in
ample, you can
range of regu-

NS
th
P
re

pportunity for
ng extra capac-
arby A-C office
Division, Mil-

A-4900

ALMERS